Volume 3
Issue 1

RISC USER

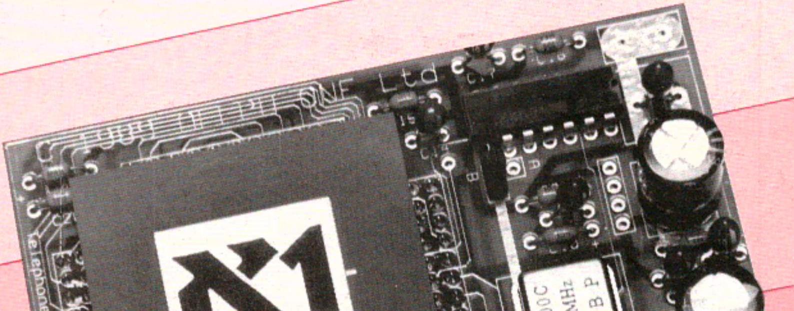
NOVEMBER 1989
Price £1.60

Introducing Laser Printers

Floating Point Instruction Set

Desktop Hotkeys Utility

Impression Reviewed



The magazine and
support group
exclusively for users
of the Archimedes

Aleph One
ARM 3 Upgrade

ISSUE
1
VOLUME 3
NOVEMBER 1989

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RISC USER

THE ARCHIMEDES MAGAZINE AND SUPPORT GROUP

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EDITORIAL

BEEBUG OPEN DAY

As reported in our news pages, the Open Day held at our new premises on 10th September proved very successful, so much so that we are now planning a further Open Day to take place on Sunday 3rd December starting again at 10am. We hope that this will not only enable us to meet even more members, but provide an excellent opportunity for your Christmas shopping.

So far Acorn Computers, Acorn User, Colton Software, Computer Concepts, Computerware and Minerva Software have all confirmed that they will be present to demonstrate their latest products. Note the date in your diaries now - full details are being circulated with the magazine.

We shall not be at the Computer Shopper Show, so the Open Day is therefore your major opportunity to purchase goods from us pre-Christmas, though our mail-order service will be fully available to satisfy the needs of those unable to attend in person. We guarantee that all orders received by 14th December will be despatched in time for Christmas (stock permitting).

BEEBUG SUMMER COMPETITION

In the July/August issue of RISC User we announced our Summer Competition with a first prize of an A3000 colour system, generously provided by Acorn. A number of other companies including Clares Micro Supplies, Colton Software, Computer Concepts and Minerva Software have also donated prizes for the runners up. There were many entries from both BEEBUG and RISC User members, which have taken much longer to evaluate than expected, and we have had to extend our original short list. We shall be announcing the name of the outright winner and of the runners up in our December issue.

BEEBUG DTP

Much interest has been aroused by the forthcoming DTP package from BEEBUG. Latest news is that the agreed price for members will now be £99.95 inc. VAT. In addition to the many features already announced, we can now reveal that BEEBUG DTP will be supplied with a number of outline fonts, a disc of high quality clipart and, of course, all the professional DTP features you would expect.

• News • News • News • News •

MEMORY UPGRADES FOR ARCHIMEDES AND A3000

At the recent PC Show in London, Watford Electronics showed first samples of its memory upgrades for the Archimedes 305 and 310, and the newer A3000, allowing all these machines to be upgraded to the maximum of 4Mbytes currently supported by the Archimedes 400/1 series. Similar memory upgrades are also available for the A400/1 series competing with Acorn's own memory upgrades. Prices range from £149 (ex. VAT) to upgrade a 410/1 to 2Mbytes to £549 to upgrade an A305/310, to 4Mbytes. For more information and details on current availability contact Watford Electronics, Jessa House, 250 High Street, Watford WD1 2AN, or tel. (0923) 37774.

ACORN INCREASES PROFITS

Acorn's latest financial report for the six months to 30th June 1989 shows an increase in turnover of just under 8%, compared with the same period last year, but an increase in profits of nearly 200% as a result of a payment by Olivetti of £1.2m. This is for an option on certain sales and marketing rights on a development project undertaken by Acorn. Profit on sales alone decreased by nearly 19% as margins were reduced by higher component costs. The overall position, however, presents a healthy picture for the once ailing Acorn, which now has a cash surplus having paid off previous debts.

ACORN ANNOUNCES MORE SPECIAL DEALS

In addition to the discount scheme for teachers who wish to purchase an Archimedes, a similar scheme has recently been announced for Acorn shareholders.

Teachers can save from £115 (inc. VAT) on an A3000 up to £230 on the cost of a system and will receive further benefits as part of the scheme. As well as a normal cash sale, teachers are also being offered a 5% finance deal over two years. This offer is available through selected dealers including BEEBUG, who can supply all the details and copies of the relevant forms.

Details of the shareholders' scheme are being distributed with the half-year results (see above), and interested purchasers then present completed forms to their dealer (e.g. BEEBUG). Savings range from £80 on an A3000 to £480 on an A440/1, but no Acorn finance scheme is available.

For more details on both schemes contact BEEBUG, 117 Hatfield Road, St Albans, Herts AL1 4JS, tel. (0727) 40303.

CONTROL ON THE ARCHIMEDES RANGE

Schools upgrading to the Archimedes range and wanting to use their new systems for console applications will be helped by new releases from Phobox Electronics. Control boxes used previously with BBC model B and Master Printer and User ports can now be controlled by an Archimedes with an I/O podule (300/400 systems) or the User/MIDI expansion card for the A3000.

There are two software products, Connect Toolbox (a relocatable module providing 19 new star commands for control), and Connect Logo, an easy-to-use addition to Archimedes Logo. In addition, a new User Port Expander allows two-port control boxes to be connected to just the User port. All items are available separately or as a complete package. For full details and prices contact Phobox Electronics, Holworth House, Holworth, Dorchester, Dorset DT2 8NJ, or tel. (0305) 853767.

NEW PRODUCTS FROM SILICON VISION

Recent releases from Silicon Vision include Arc-PCB Professional at £375, Solids Render at £79.95 and RoboLogo at £69.95 (all prices include VAT). ArcPCB Professional is claimed to be substantially faster than the original Arc-PCB package with many enhanced features.

SolidsRender is a powerful ray-tracing package, and is an ideal companion for the same company's SolidCAD or Realtime Solids Modeller. It will also integrate with Silicon Vision's Film-Maker package.

RoboLogo is described as a revolutionary new extension to traditional Logo providing three-dimensional control of an articulated humanoid or animal figure through the use of the standard Logo language.

Other products to be released shortly include Datavision, a full feature relational database, Financial Accountant, an integrated accounting and database package, and MacroManager, a companion to RISC OS.

For further information on all packages contact Silicon Vision Ltd, Signal House, Lyon Road, Harrow, Middlesex HA1 2AG, tel. 01-422 2274.

BEEBUG OPEN DAY A SUCCESS

BEEBUG's new premises were crowded on Sunday 10th September for the company's first Open Day. Acorn also lent their support along with other suppliers such as Computer Concepts and Minerva Software.

Winner of the prize draw was Ian Mayer of Scawthorpe near Doncaster who travelled down to BEEBUG in St Albans to receive his prize of an Archimedes A410/1 colour system donated by Mercantile Credit.

BEEF UP YOUR A3000

PRES Ltd. of Surrey has been working with Acorn to produce a range of upgrades for the A3000. These upgrades take the form of housings allowing up to two additional floppy or one hard disc drive to be accommodated. Further housings will take standard expansion cards (podules) designed for the Archimedes A300/A400 ranges. PRES is also planning a number of internal expansions including a disc buffer board, user port and 1MHz bus. No prices are yet available, but for more details contact PRES, P.O. Box 319, Lightwater, Surrey GU18 5PW, tel. (0276) 72046.

CHROMA GENLOCK FOR THE A3000

The Chroma 200, a genlock and video overlay card for the A3000 is now available from Wild Vision Ltd. This allows captions, titles and other special effects to be added to videos. The Chroma 200 costs £199 (plus VAT). A further release is Chromatext, for use with the Chroma series, allowing up to 35 screens of titles, captions etc. to be created and stored for use as and when required. Wild Vision are at 6 Jesmond Road, Newcastle upon Tyne NE2 4PQ, tel. 091-281 8481.

REAL-TIME VIDEO IMAGES IN 32000 COLOURS

One of the outstanding demonstrations at the recent PC Show was the ArVis range of colour video expansion boards for the Archimedes. The ArVis videographics system provides a powerful tool for the acquisition, manipulation and creation of full colour video images. The video controller and genlock card ARVC2 allows the Archimedes to combine its own display graphics with an incoming picture signal for display on the standard Archimedes colour monitor.

The videographics expansion card ARDG2 includes an amazing real-time professional colour digitiser able to grab colour images from live video at the rate of 50 frames a second. The card includes its own 384 Kbyte x 16 bit framestore memory, and can recreate images with up to 32000 different colours. Demonstrations of these devices were quite a show stopper.

Prices range from £279 (ex. VAT) for the ARVC2 board to £877 (ex. VAT) for the ARDG2 board. For full details contact Video Electronics Ltd., Wigan Road, Atherton, Manchester M29 0RH, tel. (0942) 882332.

LOW COST LASER PRINTING FOR THE ARCHIMEDES

With all the interest in DTP on the Archimedes, laser printer output is really a must, yet typically reasonable laser printers cost upwards of £3500. Most laser printers contain a very powerful computer (often more powerful than the host), and many use Postscript as the means of communication between the host and the printer.

Computer Concepts has developed a single width podule interface for the Archimedes range which provides a much cheaper solution. This uses the power and capabilities of RISC OS to perform all the image rendering before outputting the page through the podule direct to a laser printer 'engine'. This is the heart of any laser printer system and typically costs in the region of £1200. CC's podules will be available with 1, 2 or 4Mbytes of RAM at prices ranging from about £400 to near £750 (although final prices have yet to be determined) Not only that, but the Archimedes approach will result in faster printing in many cases than can be achieved by a conventional PostScript laser printer. Availability is estimated to be the end of 1989, and further details may be obtained from Computer Concepts, Gaddesden Place, Hemel Hempstead, Herts HP2 6EX, tel. (0442) 63933.

ARE YOU GOOD ENOUGH?

As the leaders in software for the Archimedes range of computers, CLARES MICRO SUPPLIES are looking to extend our range even further. We are looking for people who are as excited by the Archimedes as we are.

If you have written any programs, completed or not, then we would like to hear from you.

If you have any ideas for programs and have the ability to execute the ideas then we want to hear from you.

If you have the ability to program the Archimedes but not the ideas to program then we want to hear from you.

Programs can be written in any language as long as they perform their stated task. Many of our programs contain large chunks of BASIC with ARM code in the areas that it is needed. BASIC on the Archimedes is a very powerful language and we do not attach any snob value to its use. If your program does what is meant to do then thats all we are interested in. Why not join the top team on the Archimedes. You get the support of our in-house team, privileged access through us to Acorn and invitations to our informal programmers seminars.

The most important point is that you will be earning top royalty rates of if you prefer we will purchase your program outright.

Please write, in confidence, to Mr. D. Clare at:

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Northwich,
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If you have a program either complete or in development then please enclose a copy for our evaluation.

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The Aleph One ARM3 Upgrade

David Spencer looks at a turbo-charger for the Archimedes.

I'm sure that Roger Wilson's article on the ARM 3 processor in RISC User Volume 2 Issue 8 whetted many people's appetites, and rightfully so - a three to five times increase in speed for what is already one of the world's fastest processors is no mean feat. Now, the ARM 3 upgrade board from Aleph One allows this power to be utilised by existing Archimedes.

The ARM 3 board measures only about three inches by two, with most of this being dominated by the ARM 3 itself. This is a ceramic chip with a massive 145 pins arranged in a so-called pin-grid array. Next to the ARM 3 is a 40MHz crystal oscillator, and a small chip to divide this down to a 20MHz clock for the processor. The only other components on the board are a number of decoupling capacitors - vital with high speed circuitry. Underneath the board is a smaller daughter board, to which is mounted the 84 pin header that plugs into the existing ARM socket on the Archimedes main board.

The review unit was very much a prototype. For example, the board is a four layer unit and this was made up of two double sided boards sandwiched together. There were also obvious signs of tracks changed.

HOW IT WORKS

I will not go into great length here explaining how the ARM 3 achieves its speed improvement, as this was covered in the earlier article. Suffice to say that the ARM 3 includes a high speed 4K memory, known as a cache, which sits between the processor and main memory. As memory locations are accessed their contents are copied into the cache. Most programs access only a relatively small number of memory locations, but on a repetitive basis. Hence, many of the memory operations can be satisfied from the cache, avoiding time-consuming accesses to main memory. This provides a speed increase in two different ways. Firstly, the number of memory accesses is reduced, speeding up the processor, and secondly, as a result of this the processor can be made to run two and a half times faster, providing a further speed increase.

INSTALLATION

The ARM 3 board is, to say the least, a tight fit. To start with, the floppy drive must be removed to allow access to the ARM processor. The processor itself must then be removed, this being done with a special extraction tool supplied with the package. You simply slip the tool diagonally across the chip, squeeze the handles, and hey-presto the chip is lifted out. Aleph One obviously decided that supplying twenty pounds' worth of tool is safer than the hit and miss affair of using a small screwdriver to remove the chip. The new board is then installed by resting it on the vacated socket, and pressing it down gently. At this point I spotted what seemed to be a bit of a design flaw. The board extends to the left of the socket, trapping the disc drive cable. It would have been better had the board extended backwards, fitting neatly in front of the backplane, and I can see no technical reason for not doing this. When refitting the drive I also found that this sat right on top of the ARM 3. However, this should be avoided in production models because the genuine four layer board will be thinner than the prototype.

It must be pointed out that the ARM 3 board was installed on a 400/1 machine, and the situation may be different on a 300 series, or old 440, because of the different board layout. Additionally, the ARM 3 requires the MEMC 1A chip to be fitted. This is standard on the 400/1, but an upgrade will be needed if the ARM 3 is to be fitted to a 310 or old 440. The new board cannot be used with the A3000, for the simple reason that Acorn have surface-mount-soldered the ARM chip, which cannot therefore be removed.

There is also a potential problem with installing the ARM 3 board into a machine still under warenty. As the upgrade involves the removal of a chip, Acorn insist that it is carried out by a component-level approved service centre. These consist of Aleph One themselves, and a small number of dealers (including BEEBUG). Therefore, customers with machines in this category will have to have the upgrade fitted by one of these centres.

SOFTWARE

The ARM 3 board is supplied with a disc containing an application to control the caching. By default this is off, and therefore the application must be run to provide any speed increase, otherwise the advantage of the extra clock speed will be lost while the processor waits for the memory. The application provides an icon on the icon bar which can be clicked between a hare and a tortoise for ARM 3 or ARM 2 mode. Also included are details for controlling the cache directly, and the source code for the Desktop application.

PERFORMANCE TESTS

With an upgrade such as this on a computer like the Archimedes, there are two ways of looking at the improvement in performance. Firstly, you can take time measurements and produce figures for the speed increase, and secondly you can use the upgrade for a while and assess how it feels. Table 1 gives timings for empty loops, and loops printing characters, for the ARM 2 and ARM 3.

Operation	ARM 2 time	ARM 3 time	Speed factor
1000000 empty loop	18.82s	3.74s	5.03
100000 loop printing a single character each pass	22.69s	7.05s	3.22

Table 1: Loop timings

One point to note is the effect on the speed of the ARM 2 and ARM 3 when high resolution screen modes are used. In the Archimedes, the same RAM is shared by the processor and the video circuitry, and the latter is given priority (together with the sound system) for accessing this memory. If this was not the case then interference in the form of 'snow' would be visible on the screen. However, this does mean that the processor is halted each time the video system needs to access the memory, and therefore in memory hungry modes the ARM 2 is slowed down considerably. However, with the ARM 3, the cache provides a buffer against memory clashes, and the effect of memory intensive modes is reduced. This is shown in table 2 which gives Dhrystone figures for both processors in various modes. (The higher the figure the faster the processor's effective speed.)

Mode	0	12	20	21
ARM 2	5247	4632	3731	1876
ARM 3	12870	12407	11669	6631
Speed factor	2.45	2.68	3.13	3.53

Table 2: Dhrystones per second

As far as using the ARM 3 is concerned, the entire system feels much faster, particularly in the Desktop, where windows seem to move effortlessly. To summarise, the ARM 3 offers at least some speed increase on even the most 'cache-unfriendly' programs. However, most programs don't fall into this category, and an average speed increase of about three fold can be expected. Programs written with the ARM 3 in mind, including RISC OS itself, fare a little better, with speed increases up to four fold. On some selected test programs the speed factor can be up to 8.

The PC Emulator was tried with the ARM 3, using a very processor-intensive program, and the result was a speed increase of just 55%. Rather disappointing, but still worthwhile. In another test, the PostScript printer driver was timed performing a dump of the sample drawfile from the Apps1 disc. The output was sent to a file, rather than directly to the printer, so as to avoid the effects of the serial port speed. Here, the speed was doubled.

ARM 3 OR FLOATING POINT CO-PROCESSOR?

One of the problems with the ARM 3 board is that it will be incompatible with Acorn's new hardware floating point co-processor (which RISC User hopes to review shortly). This is a restriction imposed by the designs of the Archimedes and the ARM 3 board rather than the processor itself. The problem is that the co-processor needs to access the data bus before the cache, and hence the ARM 3 has a separate co-processor bus, which cannot be connected to the backplane of the Archimedes. Therefore, people seeking a speed increase will have to decide bewteen the ARM 3 or the hardware FP for existing machines.

An important consideration is that the ARM 3 will give a speed increase on all programs, while the floating point co-processor will only be of use with programs that use the floating point instructions, typically compiled C programs. One important point is that the FP co-processor will not make an iota of difference to the speed of Basic programs. Unfortunately, we have as yet no timings for the FP co-processor, but when we receive a unit for review we will compare it further with the ARM 3.

CONCLUSION

At first sight the Aleph One ARM 3 board appears to be fantastic - offering a three fold speed increase at less money than 'turbo' boards for other machines which typically only give 50% increases. Technically, the ARM 3 is fantastic, although the credit for this must go to Roger Wilson and his team at Acorn, and not Aleph One. However, at a price of over 688 I feel the board is too expensive, and Aleph One may well lose sales through this.

Product: ***ARM 3 Upgrade Board***
Supplier: ***Aleph One Ltd.,***
The Old Courthouse,
Bottisham,
Cambridge CB5 9BA
Tel. (0223) 811679
Price: ***688.85 (inc. VAT)***

RU

NEW RELEASES FROM DABS PRESS

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Instigator is a powerful utility which adds over eighty new commands to RISC OS, yet occupies only 53k of workspace. Instigator provides you with additional commands for memory management, colour definition, screen display, cut-and-paste, command archiving, disc management, and other general utilities. Instigator is the only '*' command toolkit which allows both desktop and command line operation. From the desktop any command can be selected from a window, with a dialogue box for parameters. The pack contains a disc of demo programs and a 128 page manual. Instigator is written by Mike Ginns, author of the acclaimed *Archimedes Assembly Language* book. Features include:

- Full intelligent memory editor, find and fill
- Colour-coded disassembler
- Disc sector editor (ADFS, MS-DOS etc.)
- Get, put and find bytes on disc
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- Fast screen load/save, with compressor
- Window creation and management
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The commands provided in Instigator:
*Archiver, *Blist, *Border, *CSD, *CSL, *CWindow, *Capture, *Colours, *Compress, *Confirm, *Cut, *Dedit, *DefineMode, *Dfind, *Dget, *Dimmer, *Diss, *Dput, *FSload, *FSsave, *FileC, *Files, *Flash, *FreeMap, *Full, *Goto, *Half, *History, *HourGlass, *ICommands, *IObey, *Istatus, *Keys, *KillModes, *KillPaths, *KillVpals, *LineEdit, *ListModes, *LoadCMOS, *LoadKeys, *LoadOSvars, *LoadPaths, *LoadVpals, *Locate, *Medit, *Mfill, *Mfind, *Mmove, *MouseCols, *OSvars, *OWindow, *Paths, *Percentage, *Printer, *RGB, *Replay, *Return, *SWI, *SaveCMOS, *SaveKeys, *SaveOSvars, *SavePaths, *SaveVpals, *Screen, *ScrollSpeed, *SetPath, *SetVpal, *Smooth, *Tidy, *UnCompress, *UsePath, *UseVpal, *Vpalettes, *WimpCom, *WinCols, *Window, *XCat, *XInfo

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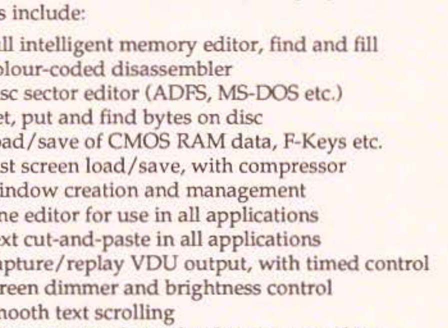

- Gym, skipping and boxing stages
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- Referee counts you out with real speech
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- Installs on hard disc

Instigator and All-In Boxing are available from your local Acorn dealer, or in case of difficulty, direct from Dabs Press (RUO), 5 Victoria Lane, Whitefield, Manchester M25 6AL. Tel. 061-766 8423. Fax. 061-766 8425. Postage free in the UK. Foreign deduct VAT and add £2.50 (surface/Europe), £12 (air). Payment by cheque, Access/MC or Visa.

Archimedes Visuals

- Shading in the 256 Colour Modes

Graham Veitch explains how to obtain a range of shades of all the basic colours in the 256 colour modes.

Many of the more subtle colour effects in the 256 colour modes are obtained by using shades of a particular colour. Sets of either eight or twelve shades can be produced for a given colour by specifying the red, green and blue components of up to 27 basic colours, and an associated *intensity* value. However, the 256 colour modes (such as mode 15) require that a colour be selected as a colour number in the range 0 to 63, and one of four values of tint (0, 64, 128, or 192). The program listed here makes the conversion easy, displaying all the shade sequences for reference. It also provides a function (FNshades) which you can incorporate into your own programs to convert any red-green-blue combination and an intensity into the corresponding colour number and tint.

The function, FNshades, takes as parameters values for the r(ed), g(reen) and b(lue) components of a desired colour series, and an int(ensity) to select the shade within that series. It returns the colour number to be displayed as the value of the function, and the tint, from 0 to 3, as a RETURN variable in the parameter list. That is:

```
col=FNshades(r,g,b,int,RETURN tint)
GCOL col TINT tint*64
```

The function can be used to produce eight colour series of twelve shades each, corresponding to the eight steady default colours in 16 colour modes. You may need to turn down the brightness control on your monitor to eliminate "white banding" and to see the series as continuous where possible. In order to see the darker shades, you may also find it necessary to turn up the contrast control.

For these series, the values of red, green and blue should be either 0 or 1 (hence eight different colour series), and an intensity in the range 0 to 11. However, the series with red=0, green=0, blue=0 (rgb=000) produces four shades of grey repeated three times: a grey scale of twelve shades is available with rgb=111.

The same function can also produce twenty-seven series of colours with eight shades each. In these cases, the values of red, green and blue should each be in the range 0 to 2, with the intensity specified between 0 and 7.

This second use of the function is on the whole less useful than the first for the colours (combinations of red, green and blue) which can be obtained by either method. For example, with the first method, a cyan series of 12 shades can be obtained with rgb=011. Using the second method, there are two series which produce shades of cyan: rgb=011 and rgb=022. These two series overlap at certain intensities, and so this second method can be less easy to work with.

The second method does however allow shades of extra colours, such as orange (rgb=210) and cream (rgb=221) to be used. Both groups are demonstrated in the program shown. However, only FNshades is needed in your own programs.

```
   10 REM          >Colours4
   20 REM Program  Colour Series
   30 REM Version  A 0.6
   40 REM Author   Graham Veitch
   50 REM RISC User November 1989
   60 REM Program  Subject to Copyright
   70 :
   80 MODE 15:tint%=0
   90 PRINTTAB(22, 1);"INTENSITY FROM 0
TO 7"
  100 PRINTTAB(6,3);"r = 0"
  110 PRINTTAB(30,3);"r = 1"
  120 PRINTTAB(54,3);"r = 2"
  130 PRINTTAB(22,20);"INTENSITY FROM 0 TO 11"
  140 VDU 5
  150 PROCseries12
  160 PROCseries8
  170 VDU31,0,31
  180 VDU4
  190 END
  200 :
  210 DEF PROCseries12
  220 FOR b%=0 TO 1:FOR g%=0 TO 1
  230 FOR r%=0 TO 1:FOR int%=0 TO 11
  240 col%=FNshades(r%,g%,b%,int%,tint%)
  250 GCOL col% TINT tint%*64
  260 RECTANGLE FILL int%*32+320,(b%*4+g%*2+r%)*32+64,32,32
  270 NEXT int%
  280 GCOL 63 TINT 192
  290 PRINT" r,g,b = ";r%;",";g%;",";b%
  300 NEXT r%,g%,b%
  310 ENDPROC
  320 :
  330 DEF PROCseries8
  340 FOR b%=0 TO 2:FOR g%=0 TO 2
  350 FOR r%=0 TO 2:FOR int%=0 TO 7
  360 col%=FNshades(r%,g%,b%,int%,tint%)
  370 GCOL col% TINT tint%*64
  380 RECTANGLE FILL (r%*12+int%)*32,(b%*4+g%)*32+512,32,32
  390 NEXT int%,r%
  400 GCOL 63 TINT 192
  410 PRINT" g,b = ";g%;",";b%
  420 NEXT g%,b%
  430 VDU 4
  440 ENDPROC
  450 :
  460 DEF FNshades(r%,g%,b%,int%,RETURN tint%)
  470 LOCAL vol%
  480 tint%=int% MOD 4
  490 vol%=int% DIV 4+1
  500 r%=r%*vol%:g%=g%*vol%:b%=b%*vol%
  510 IF r%=4 THEN r%=3
  520 IF g%=4 THEN g%=3
  530 IF b%=4 THEN b%=3
  540 =b%*16+g%*4+r%
```

RU

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Introducing Laser Printers

by David Spencer

With the advent of desktop publishing on the Archimedes, many users may now be considering the purchase of a laser printer. These devices cost considerably more than a 9 pin dot matrix printer, but the quality of their output is incomparable. And with starting prices falling below the £1000 mark their appeal is gaining ground. In this, the first of a number of articles on laser printers, we explore the basic concepts.

HOW THEY WORK

The functioning of a laser printer is quite different from that of any other type of printer. Unlike dot matrix or ink jet printers, laser printers use a Xerographic process similar to that of photocopiers. The detailed operation of all laser printers differs slightly from model to model, but the following explanation is general enough to cover all devices.

As with all printers, a laser printer can be split into two quite distinct parts. There is the printer mechanism and the electronic control circuitry. The mechanism, which we will come back to later, is normally referred to as the print engine, and it is very common for this to be manufactured by a totally different company to that making the rest of the printer. The control electronics, in common with most other printers, consist of a dedicated computer. However, there is one major difference here between a laser printer and any other type. While normal printers have only a very simple processor, and only a few kilobytes of RAM, the control computer of a laser printer is frequently more powerful than the computer to which it is connected. For example, a fairly standard control system consists of an MC68000 16-bit processor with 1Mb of RAM and 1/2Mb of ROM. The powerful processor and large RAM are needed because the printer works at such a speed that an entire page must be built up in memory before it is printed. With a resolution of 300 dots per inch, an A4 page, assuming a margin of 1/2" on each edge, requires about 854K in which to store it.

THE PRINTER ENGINE

Figure 1 shows a schematic view of a typical laser printer engine. The Xerographic printing process works by using electrostatic charges to transfer the image onto the paper. The central component of the system is the master, which consists of a thin sheet of a special metallic alloy wrapped around a rotating plastic cylinder called the drum. This can be seen at the centre of the diagram. The master is designed so that it can hold a static electrical charge, but discharges as soon as it is exposed to light. This is achieved by constructing the master from a photoconductive material such as selenium or cadmium.

Mounted very close to the drum is a fine wire, or in some cases a mesh of wires, called the corona wire. By applying a very high voltage across the corona wire, an electric field is built up, and because of the close proximity of the master, a static charge is induced on the surface of the master. In most systems this is in fact a negative electrical charge. Because the drum rotates, the entire surface of the master will be charged as it passes the corona wire.

The next stage involves the laser itself. A laser is basically a specialised form of light source. It differs from, say, a light bulb in two ways. Firstly, the light produced is monochromatic, which means that it is a single precise colour. Secondly, and more important to a laser printer, the light is coherent. This means that the light doesn't diverge after leaving the laser. In a perfect vacuum, if the ray of light leaving the laser was 1mm wide, it would still be 1mm wide thousands of miles away. In practice, air molecules deflect the beam, but it still remains coherent for several inches. This means that a precise pattern can be traced out using a laser beam.

In a typical laser printer, the laser beam is arranged so that it can scan the surface of the drum from left to right, rather like the electron beam within a television tube. This is performed by refracting the beam through a rotating prism, as shown in figure 2. The beam detector (a photocell) seen in the diagram is needed so that the actual position of the laser can be detected.

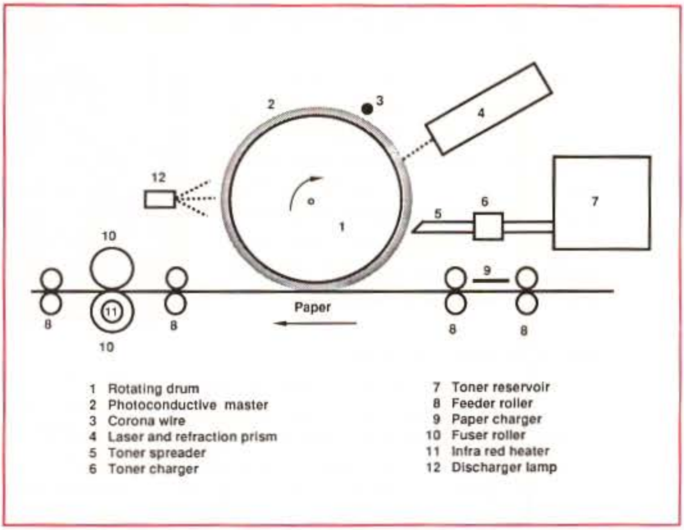

Figure 1. Simplified schematic of laser printer engine

In a laser printer, the arrangement is such that the laser beam strikes the master just after it has been charged by the corona wire. Any area of the master which the beam strikes will be discharged, because of its photoconductive properties. By pulsing the laser on and off, it is possible to 'draw' a single line of dots on the master. A dot which will eventually be black will be a discharged point on the drum, and a blank dot will remain charged.

An optical encoder disc mounted on the prism ensures that the laser is turned on and off at the correct times. Because the drum is rotating as the laser scans across, the next pass of the beam will fall on the next row down. This is very similar to a television tube, except that the surface being scanned is wrapped around a cylinder.

At this point, the image exists on the surface of the master, as a series of charges. A discharged area represents a black dot, and a negatively charged area a white dot. It is now that the actual toner is introduced. Toner is a very fine powder consisting of a mixture of a low melting point glue and carbon particles (soot). The toner is kept in a reservoir within the printer, and is fed out by a feeder system. As the toner leaves the reservoir, it is also negatively charged by a corona wire. A spreader creates a band of toner the same width as the drum.

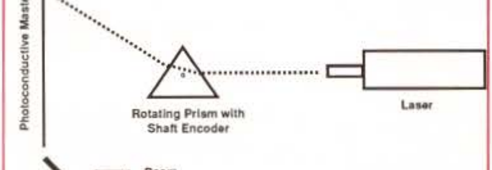

Figure 2. Optical components of a laser printer

As the drum passes the toner, the electrical charges interact with each other. Because the toner is negatively charged, it will be strongly repelled by the areas of the master which are still charged. However, the toner will be attracted to the discharged regions of the master. The effect of this is to convert the image on the master from a static charge to actual toner.

The next part of the process involves the transfer of the toner from the drum onto the paper. Again, this uses electrical charges. As the paper enters the printer, it is given a positive charge by yet another corona wire. The drum rolls over the surface of the paper, and the negatively charged toner is attracted to the oppositely charged paper. The result is a perfectly formed image on the paper. However, at this point the toner is still loose.

To fix the image onto the paper a fuser is used. This normally consists of two very smooth ceramic rollers which are heated by an infra-red heater inside one of them. The paper is passed between the rollers which heat it up to about 200 degrees Celsius. This melts the glue in the toner and firmly fixes it to the paper.

This is not quite the end of the story. Although one page has been produced perfectly, we need to consider the next page. It is highly likely that some residual charge will remain on the master, and this needs to be removed. This can be done using either another corona wire, or more simply using a light source to remove the charge.

MAINTENANCE

With dot matrix printers, the only maintenance needed is normally a ribbon change when the printing becomes faint, and an occasional blow out of any dust. However, the extra complexity of laser printers leads to greater maintenance needs. Cleaning is very important, and must be performed after a certain number of pages have been printed (about 1000).

This normally involves cleaning all the rollers and corona wires. Of course, the toner must be refreshed periodically, and the photo-conductive master must be changed at regular intervals. Many laser printers use changeable toner cartridges which not only include a new supply of toner, but also a new master. These can cost up to £100 each, and this explains the printing cost of several pence a page.

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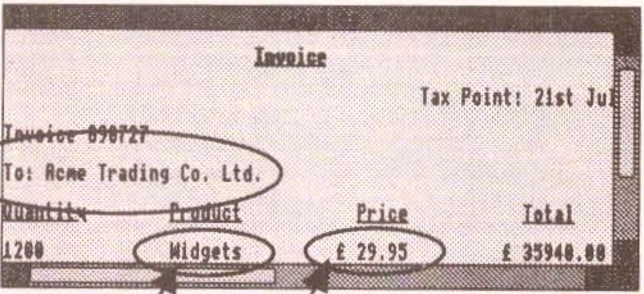
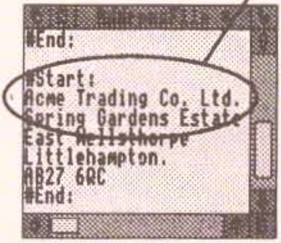


```
                    Invoice

                             Tax Point: 21st Ju

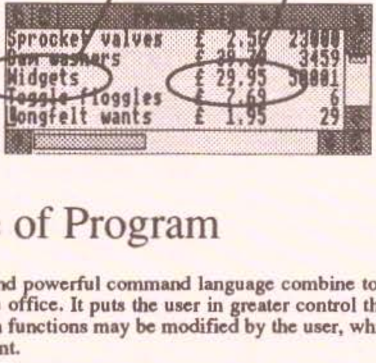
Invoice 890727
To: Acme Trading Co. Ltd.
Quantity      Product        Price       Total
1200          Widgets        £ 29.95     £ 35940.00
```



```
#End:

#Start:
Acme Trading Co. Ltd.
Spring Gardens Estate
East [illegible]
Littlehampton.
AB27 6RC
#End:
```

Dynamic Text



```
Sprocket valves   £ 2.5[illegible]  23000
[illegible] washers   £ [illegible]  3459
Widgets           £ 29.95  50001
Toggle floggles   £  7.69      6
Bongfelt wants    £  1.95     29
```

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Premier 3 will be available from the 1st December 1989. This definitive version includes fast 'in memory' data transfer between other applications, extended spreadsheet functions, and faster screen refresh. New facilities allow the independent control of screen and printer output. Older version discs may be upgraded free of charge (including full notes on disc), or complete with the new word processor manual and thesaurus, for £17.35 + VAT.

Premier 3 may be purchased directly by phone, quoting your MasterCard (Access) or Visa card number, or from your nearest Acorn dealer. Educational discounts and multi-machine licences are available.

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PAGE DESCRIPTION LANGUAGES

Most laser printers offer a similar level of intelligence to dot matrix devices. For example, there are commands to change the line spacing, the print style etc, and to enter a bit image graphics mode. Some printers, for example the Epson GQ3500, also support a set of drawing primitives which can draw shapes (circles, squares etc.) on the page at a specified position and size. There is, however, a totally different level of command interface - called a Page Description Language (PDL), of which PostScript is the most common.

PostScript is more than a set of commands; it is in fact a complete programming language with all the features you would expect in a more generalised language such as Basic. Also, like Basic, PostScript is an interpreted language, meaning that the program is analysed each time it is executed. Unlike a normal language, PostScript actually executes the program as it is being transferred to the printer from the host computer. The structure of PostScript is unusual. It relies totally on the use of stacks and reverse polish notation (a type of arithmetic that operates on stacks). There is also widespread use of data types called dictionaries, which are lists of keywords and corresponding objects, where an object can be anything from a simple number to a complex procedure.

As far as built-in commands go, PostScript is, not surprisingly, rich in graphics commands. The system works by drawing a complete image of the page directly into memory, and then printing it. Each individual graphics element is made up by forming a path from a series of lines and curves, and then converting that into an actual image in some way, for example by drawing the outline, or filling the path to create a solid object. Most graphics will be made up in this way, although it is possible to include bit images on the page, and these can be scaled and repositioned as necessary.

PostScript is particularly suited to printing text in a wide variety of typestyles (fonts). The definitions of the fonts are either stored in ROM within the printer, or downloaded from the host computer when they are needed. Like the new outline fonts on the Archimedes, PostScript fonts are stored as a series of lines making up the outline of each character. When a character is printed the definition is scaled to the appropriate size, and the outline filled in to produce a solid character. This has the massive advantage that whatever size the character is scaled to, the resolution to which it is printed is that of the printer. With a bit-image font, resolution is lost as the characters are scaled up.

The disadvantage of PostScript is that it can add as much as £2000 to the price of a printer. This is partly due to the extra complexity of the printer electronics, but mainly because the rights to the use of the language are owned by one company, Adobe. Any manufacturer wishing to implement PostScript has to pay Adobe an initial fixed sum, followed by a percentage of the cost of each printer sold. Even so, as prices continue to fall, PostScript printers can now be purchased from around the £2000 mark (+VAT), mainly due to the advent of PostScript clones which don't suffer from the same licencing charges.

Next month we continue the theme of laser printing with some practical investigations.

PostScript is a trademark of Adobe Systems Incorporated.

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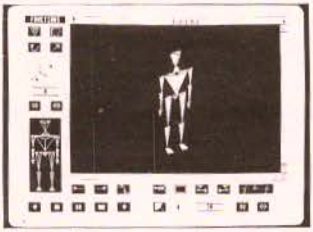

This revolutionary new extension to traditional LOGO, made possible only by the enormous computational power of the Archimedes, provides three dimensional control of an articulated humanoid or animal figure through the use of a standard LOGO language. Sophisticated natural commands such as 'Walking', 'Turning', 'Bowing', and 'Picking', etc are automatically represented graphically by natural movements of the 3D figure. This natural form of graphical response is readily understood by students using LOGO to learn the concepts of logic & reasoning. The traditional Turtlegraphics & 3D Glider features are also supported for easy transition to this innovative concept in natural response LOGO.

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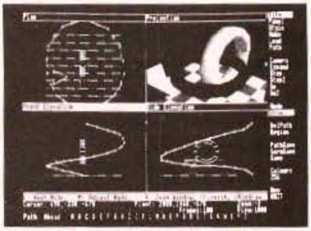

The package provides an interactive environment to create animated sequences of 3D scenes with dynamic camera motion for 'walk-throughs' and 'flight-paths' for objects within the scene. The fully graphical environment requires no programming or textual entry and the capability to calculate smooth shaded frames of complex scenes with lighting effects at rates of 60 minute allows fast interactive design of animated sequences. A large number of these frames can then be stored using built-in compression facilities to play-back at video scan rates for on-screen animation or video recording. Fully compatible with SolidCAD and SolidsRENDER, animation Oscars are now within your reach.

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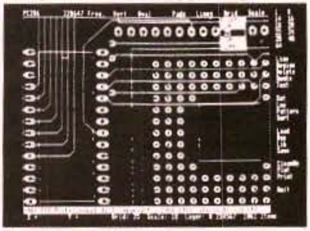

The ultimate PCB design package developed specifically for the Archimedes is now even better. ARC-PCB Professional follows on the success of the original and provides Faster & Improved Automatic Routing, Oval & Circular pads with fully variable sizes, Faster Redraw, Extended library part manipulation, & Instant Editing operations for substantially increased productivity. This Professional version operates orders of magnitude faster than the original and surpasses all other PC-based PCB design systems in features & speed of operation for the fastest turnaround from concept to finished board design. Take the lead for your PCB designs before your competitors do.

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A Desktop Hotkeys Utility

by Glynn Clements

While the mouse-controlled Desktop is easy to use, there are some tasks which would benefit from single key operation. For example, it would be nice to be able to press key 0 to open a directory viewer on drive 0.

The accompanying utility allows you to do this and much more. When you double-click on its icon, it will sit on the icon bar, and provide a whole set of customisable single-key shortcuts. As it stands, it will open directory viewers on disc drives, the network if fitted, and the RAM filing system if installed, and will save the current screen to disc - but you can add whatever functions you like.

ENTERING THE PROGRAM

First you will need to create a new directory called !Keys for the application (click the Menu button in the directory viewer where you want to save the application, select the 'New directory' submenu and enter '!Keys' into the writeable icon). Open the application directory just created by double clicking on its icon while holding down the Shift key (standard practice for an application directory). Inside this create another directory called Screens.

Now use Edit to create a new Obey file containing listing 1 (click with the Menu button on the Edit icon, and select the New Obey File option from the Create submenu). Save this file in !Keys with the name !Run. Then use Paint to create a sprite called !Keys in mode 12, 34 pixels wide by 17 pixels high (see last month's article in the series *Into the Arc* for detailed information on the creation of sprites for this purpose). This sprite will be used to represent the application in directory viewers and on the icon bar.

Save the sprite file in the directory !Keys with the name !Sprites. Finally type in the Basic program given as listing 2 and save it in directory !Keys with the name !RunImage.

Listing 1

```
Set Keys$Dir <Obey$Dir>
WimpSlot -min 16K -max 16K
Run <Keys$Dir>.!RunImage
```

USING THE PROGRAM

Enter the Desktop and open the directory viewer containing the !Keys application. Double clicking on the !Keys icon will start the application and install its icon on the icon bar. From then on, pressing any of the following keys will have the desired effect.

0-7	**Open root directory of drive specified**
/	**Open user root (&) on network**
*****	**Open root ($) on network**
#	**Open root of RAM disc**
Print	**Save screen**

The program will not try to open directory viewers on non-existent drives, but can still produce errors, e.g. 'Drive empty' for disc, 'Not logged on' for network, and 'Filing system or path RAM: not present' if the RAM disc is inactive.

Screens are saved in the Screens directory with the filename ScreenX, where X is an incrementing counter to ensure that each file has a unique name. The first screen will be saved as Screen1. A new screen is saved with a number one higher than the highest already existing.

It is important to realise that all keypresses are first offered to the active application - the one owning the caret (the red bar that shows where text is to be entered). This means that if the caret is visible, then some of the keypresses may not work. Changing the keys used can help, as writeable icons generally respond to letters and digits but not to function keys. The keys are specified in lines 500 to 540 of the program.

TECHNICAL DETAILS

The program works by opening a window to the left of the visible screen area (i.e. negative x co-ordinates), with the

GRAB_KEYS bit (bit 12 of the window flags) set. Whenever a key is pressed and the owner of the caret (if there is one) doesn't want it, it will be passed to Wimp_ProcessKey. This offers it to all open windows with the GRAB_KEYS bit set, topmost window first. When the key is offered to the Hot Keys application, PROCkeys is called (line 650). This is basically a CASE statement which takes one of a number of actions depending on the key pressed. You can add your own features by adding new WHEN clauses to the CASE statement. If no action is taken, the key is passed to Wimp_ProcessKey in case any other task wants it.

The Task Manager uses exactly the same method for entering the CLI shell when F12 is pressed. If you examine its Wimp Template file (DeskFS:Templates.Switcher) using FormEd (supplied on last month's disc), you will find a window called GrabKeys just for this purpose.

This application can be found in full (with a sprite) on this month's magazine disc.

```
   10  REM              > !RunImage
   20  REM Program      !Keys
   30  REM Version      A1.0
   40  REM Author       Glynn Clements
   50  REM RISC User October 1989
   60  REM Program subject to copyright
   70  :
   80  PROCinit
   90  ON ERROR bk%!0=ERR:$(bk%+4)=REPOR
T$:SYS "Wimp_ReportError",bk%
  100  REPEAT
  110   SYS "Wimp_Poll",&33,bk% TO reaso
n%
  120   CASE reason% OF
  130   WHEN 2: SYS "Wimp_OpenWindow",,b
k%
  140   WHEN 6: IF bk%!12=-2 AND bk%!16=
icon_handle% AND (bk%!8 AND 2) AND NOT(b
k%!20 AND 2) THEN SYS "Wimp_CreateMenu",
,mbk%,bk%!0-64,140
  150   WHEN 8: PROCkeys
  160   WHEN 9: quit%=TRUE
  170   WHEN 17,18: IF bk%!16=0 THEN qui
t%=TRUE
  180   ENDCASE
  190  UNTIL quit%
  200  SYS "Wimp_CloseDown"
  210  END
  220  :
  230  DEF PROCinstall_icon
  240  bk%!0=-1:bk%!4=0:bk%!8=0:bk%!12=6
4
  250  bk%!16=68:bk%!20=&3002:$(bk%+24)=
"!Keys"
  260  SYS "Wimp_CreateIcon",,bk% TO ico
n_handle%
  270  ENDPROC
  280  :
  290  DEF PROCwindows
  300  LOCAL dummy_handle%,b%
  310  b%=bk%+4
  320  b%!0=-8:b%!4=0:b%!8=-4:b%!12=4
  330  b%!16=0:b%!20=0:b%!24=-1
  340  b%!28=&80001050:b%!32=0:b%!36=0
  350  b%!40=0:b%!44=-4:b%!48=4:b%!52=0
  360  b%!64=0:b%!68=0:b%!84=0
  370  SYS "Wimp_CreateWindow",,bk%+4 TO
 dummy_handle%
  380  bk%!0=dummy_handle%
  390  SYS "Wimp_OpenWindow",,bk%
  400  ENDPROC
  410  :
  420  DEF PROCmenu
  430  $mbk%="Info":mbk%!12=&70207:mbk%!
16=100:mbk%!20=44:mbk%!24=0
  440  mbk%!28=&80:mbk%!32=-1:mbk%!36=&0
7090011:$(mbk%+40)="Quit"
  450  ENDPROC
  460  :
  470  DEF PROCkeys
  480  LOCAL key%:key%=bk%!24
  490  CASE TRUE OF
  500  WHEN key%>=&30 AND key%<=&37: PRO
Cdrive(key%-&30)
  510  WHEN key%=ASC("#"): OSCLI "Filer_
OpenDir RAM:$"
  520  WHEN key%=ASC("*"): PROCnet("$")
  530  WHEN key%=ASC("/"): PROCnet("&")
  540  WHEN key%=&180: PROCscreensave
  550  OTHERWISE: SYS "Wimp_ProcessKey",
key%
  560  ENDCASE
  570  ENDPROC
  580  :
  590  DEF PROCinit
  600  SYS "Wimp_Initialise",200,&4B5341
54,"Hotkeys"
  610  buffsize%=20:DIM bk% 500,mbk% 44,
data% 150,name% 10,rec% 64,buff% buffsiz
e%
```

```
  620  PROCwindows:PROCinstall_icon:PROC
menu:quit%=FALSE
  630  ENDPROC
  640  :
  650  DEF PROCdrive(drive%)
  660  LOCAL floppies%,winnies%
  670  SYS "ADFS_Drives" TO ,floppies%,w
innies%
  680  IF drive%<4 THEN
  690   IF drive%<floppies% THEN PROCdis
c(drive%)
  700  ELSE
  710   IF drive%<winnies%+4 THEN PROCdi
sc(drive%)
  720  ENDIF
  730  ENDPROC
  740  :
  750  DEF PROCnet(dir$)
  760  LOCAL ptr%
  770  SYS "NetFS_ReadFSName",,buff%,buf
fsize% TO ,ptr%
  780  ?ptr%=13
  790  OSCLI "Filer_OpenDir net#"+$buff%
+":"+dir$
  800  ENDPROC
  810  :
  820  DEF PROCdisc(drive%)
  830  LOCAL i%
  840  SYS "ADFS_DescribeDisc",":"+STR$(
drive%),rec%
  850  i%=rec%+22:WHILE ?i%>32:i%+=1:END
WHILE:?i%=13
  860  OSCLI "Filer_OpenDir adfs::"+$(re
c%+22)+".$"
  870  ENDPROC
  880  :
  890  DEF PROCscreensave
  900  LOCAL max%,next%,data%
  910  max%=0:next%=0
  920  REPEAT
  930   SYS "OS_GBPB",9,"<Keys$Dir>.Scre
ens",buff%,1,next%,buffsize%,"Screen*" T
O ,,,,next%
  940   ptr%=buff%:WHILE ?ptr%<>0:ptr%+=
1:ENDWHILE:?ptr%=13
  950   IF LEFT$($buff%,6)="Screen" THEN
 data%=VAL(MID$($buff%,7,LEN($buff%)-6))
 ELSE data%=0
  960   IF data%>=max% THEN max%=data%+1
  970  UNTIL next%=-1
  980  OSCLI "ScreenSave <Keys$Dir>.Scre
ens.Screen"+STR$(max%)
  990  ENDPROC
```

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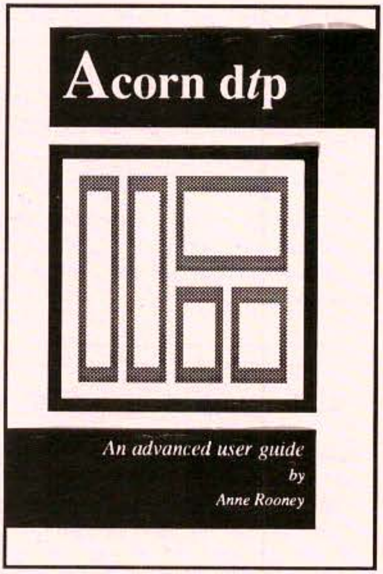

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Access

The Floating Point Instruction Set

David Spencer takes a two- part look at the ARM floating point instructions.

The arithmetic instructions offered by the ARM processor are limited to addition, subtraction and multiplication of 32-bit integers. While this is adequate for many programs, there are situations where it is necessary to use floating point numbers - that is numbers which are not integers. It is of course possible to write routines to do floating point arithmetic, but these tend to be rather complex and long-winded. The ARM offers an alternative, by way of a number of floating point instructions which extend the basic instruction set of the processor. However, unlike ordinary instructions, these new ones are not executed directly by the processor. Instead, there are two possible ways by which they can be handled. Firstly, there is the *Floating Point Emulator* (FPE) which is supplied on disc with the Archimedes. When the ARM attempts to execute an instruction which it doesn't understand, such as a floating point operation, it jumps through a vector in memory. Normally this will produce an 'Undefined Instruction' error, but the FPE intercepts the vector, picks out floating point instructions, and emulates them in software.

The other alternative is to use a hardware floating point co-processor. This is a second processor attached directly to the ARM. When the ARM doesn't understand an instruction it offers it to the co-processor. If the co-processor can execute the instruction, then it will, and the ARM doesn't jump to the illegal instruction vector. Rather than developing a custom co-processor which could understand all of the floating point instructions, Acorn have decided instead to produce a unit which handles only a subset of the instructions, and the rest are still emulated in software. Whatever the setup, the floating point instructions appear to the user's program as normal instructions. The only difference between the hardware and software solutions is one of speed. For the purposes of this article, the term FP processor will be used to describe the virtual processor emulated by either software, or a hardware software combination.

WHAT IS FLOATING POINT?

Before looking at the FP instruction set, we need to clarify just what a floating point number is. Earlier, we described them as numbers which are not integers, but this is not the formal definition.

FLOATING POINT REPRESENTATION

In mathematics, floating point numbers are often represented using a notation called standard form (also known as scientific notation). With this method, a number is written as:

$m*10^e$

for example, $1.2*10^{-3}$ or $6.9*10^{67}$
In computer languages, standard form numbers are usually entered using an E to represent the middle part, making the above examples 1.2E-3 and 6.9E67. What this notation indicates is that the real value of the number is *m*, the *mantissa,* multiplied by 10 raised to the power of e, the *exponent.* Multiplication and division by powers of ten can also be thought of as shifting the decimal point right or left, with the value of the exponent corresponding to the amount of shift. For example, 1.2E-3 is 1.2 with the decimal point shifted left three places - in other words 0.0012, while 6.9E67 is 69 followed by 66 zeros.

You might have spotted that using our definition so far, any number can have many representations, for example 3.21E4 is the same as 32.1E3 and 0.321E5. To remove this ambiguity, it is convention that the number should always be written with exactly one non-zero digit to the left of the decimal. This is what makes the form 'standard' and therefore only the first of the three representations for 32100 given above is valid. A number in standard form is said to be *normalised,* and the process of converting it to standard form is called *normalisation.*

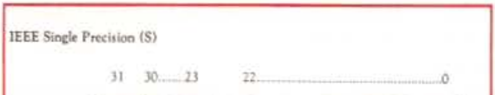

Figure 1. The available precisions

The range of values allowed for the exponent determines the largest number that can be specified, and the smallest (closest to zero), while the number of digits in the mantissa controls the accuracy. Clearly, if you only had one digit for the mantissa then most of the accuracy of the number would be lost when represented in this form. In practice, an accuracy of about ten digits is suitable for most applications, but if greater precision is required then you do away with standard form and write the numbers as they are, digit by digit.

In almost all computer representations of floating point numbers, a scheme similar to standard form is used. However, because computers are more at home with the binary number system, powers of two rather than ten are used. This means that numbers come in the form $m*2^e$. The Acorn FPE supports three different representations of this form, each with a differing precision. These are called Single (S), Double (D) and Extended Double (E) precisions, and take up one, two and three words of memory respectively. Figure 1 shows the layout, and figure 2 summarises the number of bits used for the exponent and mantissa in each form, and the precision and range implied by this.

Prec.	Exp. bits	Mant. bits	Range (+/-)	Accuracy (in digits)
S	8	23	3.4^{38}	6.5
D	11	52	1.8^{308}	15.5
E	15	80	1.2^{4932}	24

Figure 2. Range and accuracy for different precisions.

One point to note is that negative numbers are not stored using two's complement form (as they are with integers). Instead, a negative mantissa is represented by setting the bit labelled *sign* in figure 1, while exponents use a form called *excess notation,* which works as follows. Suppose that the exponent uses eight bits (as it does for single precision). This gives 256 possible values for the exponent, and we will split these equally to give the range -128 to 127. Given an exponent in this range, it is stored by adding 128 to it, which will ensure that the exponent always appears positive. D precision on the other hand has an eleven bit exponent giving a range of -1024 to 1023. In this case, 1024 is added to force the value positive.

Normalisation is another area to bear in mind. All numbers stored in S, D or E precision are normalised so that the bit to the left of the binary point is always a one, giving a mantissa in the range 1<=m<2. Because this bit is always a one, it is not actually stored, except in the E format where it is placed in the bit labelled J in figure 1.

There is also a special format called Packed Decimal (P), in which a number is represented as a string of decimal digits rather than in standard form. We will cover this in next month's article.

THE FLOATING POINT ARCHITECTURE

Just as the ARM has an internal set of registers, so does the FP processor. In fact, the FP processor adheres to a standard called IEEE 754, easing the problem of porting software from other systems. There are eight floating point registers, and although it is not specified how these are organised, it is guaranteed that each one can hold a number to the maximum precision (double extended).

There is also a floating point status and control register which is used to hold certain error conditions. This is shown in figure 3. The bottom five bits are used by the FP processor to indicate possible error conditions. These have the following meanings:

IVO (Invalid operation) - A silly operation has been attempted, such as one involving a previously undefined result, or trying to take the inverse sine of a value out the range -1 to 1.

DVZ (Division by zero) - An attempt has been made to divide a non-zero value by zero.

OFL (Overflow) - The result of an operation was too big to be stored to the chosen precision.

UFL (Underflow) - The result of an operation is so close to zero that it can only be represented as zero using the chosen precision.

INX (Inexact) - The rounding process has changed the value of the calculated result. This will usually be more of a warning rather than an error.

The action taken when one of the status flags is set depends on the interrupt masks in the status register, these being set by the user's program. If, for any particular flag, the corresponding interrupt mask is not set, then a sensible value will be assigned as the result. For example, an underflow will return a zero result, and an overflow will produce infinity with the correct sign. If, on the other hand, the appropriate interrupt mask is set, then the FP processor will generate a fatal error which can be picked up by the user's program.

31........21	20	19	18	17	16	15.....5	4	3	2	1	0
	INX	UFL	OFL	DVZ	IVO		INX	UFL	OFL	DVZ	IVO
	Interrupt Masks						Cumulative Flags				

Figure 3. The FP status register

THE FLOATING POINT INSTRUCTION SET

We can now start to look at the actual floating point instructions. One point to note here is that Basic's built-in assembler doesn't support the FP instructions, although the Acorn assemblers AASM and OBJASM do. In order to use the instructions within the Basic assembler, you can either work out the binary value of the opcode and poke it in using the EQUD operator, or use the power of Basic to implement functions to assemble the instructions. A program that uses this latter approach is provided on this month's magazine disc, together with full instructions.

Another obvious point, but one that is easily overlooked, is that the FP Emulator must be installed before using the instructions. The Emulator can be found in the modules directory of the !System application (Apps 1 disc), and can be loaded with *RMLOAD.

The first instructions we will examine are LDF and STF which are used to load or store the contents of a floating point register to or from memory. These take the form:

```
LDF<prec> Fd,[Rn]<,#offset>
LDF<prec> Fd,[Rn,#offset]<!>
```

<prec> represents a single letter indicating the precision to be used, as described above. The possible letters are S, D, E and P for single, double, extended and Packed BCD. A precision must always be given, so the mnemonic will look something like LDFS or STFD. The operands may look horrendous, but they are in fact similar to those of the normal load and store instructions LDR and STR. Both pre and post-indexed addressing is allowed, although the offset in the address can only be a number in the range -1020 to 1020. Unlike LDR and STR it cannot be a register, and it cannot contain a shift specification.

As with LDR and STR, an optional '!' on the end of the instruction is used to write back the address to the base register, and is only applicable to pre-indexed addressing. The Fd part of the operand is a register from F0 to F7 specifying which floating point register to use. The address used for the load or save, formed by adding the contents of Rn to the offset, must be word-aligned, and the number of words used for the storage depends on the chosen precision.

Here are some examples of the LDF and STF instructions:

```
LDFS F0,[R1,#128]
```

Pre-indexed load without writeback

```
STFD F0,[R2,#-64]!
```

Pre-indexed store with writeback

```
LDFE F1,[R2],#24
```

Post-indexed load

Next month we will look at the remaining floating point instructions.

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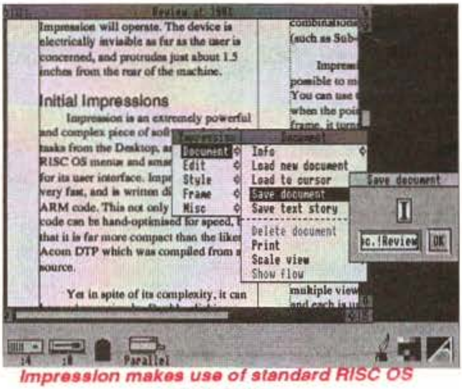
Early Impressions

Computer Concepts' new document processor reviewed by Lee Calcraft.

INSIDE THE BOX

Impression is the second DTP package to appear for the Archimedes. Acorn DTP was released a couple of months ago, and at least two more contenders - from Beebug and from Clares - hover in the wings. At the time of writing, Impression has not yet reached a final release version. It is expected that this will take at least another four weeks, and possibly more. The version tested here is a so-called beta-test version, which contains almost all the features to be implemented in the final version, and, I am pleased to report, very few bugs.


Impression will operate. The device is electrically invisible as far as the user is concerned, and protrudes just about 1.5 inches from the rear of the machine.

Initial Impressions

Impression is an extremely powerful

Impression makes use of standard RISC OS menu trees

The very smart packaging for the product is already finished, and contains an almost completed manual and four discs (including a disc of Acorn's new outline fonts, and one containing a number of pictures in bit-image and draw file format), and a dongle. This latter device must be plugged into the parallel printer port at the rear of the Archimedes before Impression will operate. The device is electrically invisible as far as the user is concerned, and protrudes just about 2 inches from the rear of the machine. Additionally, the pack will contain a book on desktop publishing.

INITIAL IMPRESSIONS

Impression is an extremely powerful and complex piece of software. It multitasks from the Desktop, and uses trees of RISC OS menus and smart dialogue boxes for its user interface. Impression is also very fast, and is written directly in native ARM code. This not only means that the code can be hand-optimised for speed, but that it is far more compact than the likes of Acorn DTP which was compiled from a C source.

Yet in spite of its complexity, Impression can be used very simply. Double-clicking on its quill icon in the directory viewer will install it on the icon bar. Clicking on this will open up a new document (you can open as many as you want). Alternatively, dragging a previously-saved document to the quill icon will open a window on it.

In either case you can then just type away. Text will appear on the screen as you type, paragraphs will automatically format themselves, and text will flow from one column to the next, and from one page to the next. Many word processors which use the anti-alias fonts have trouble keeping up. But Impression manages admirably - even when inserting text into the middle of a left-hand column, with an overflow into the next. Only when very large text is used, or when Draw file format pictures are displayed is there a noticeable delay when scrolling.

You really can use it to "bash out" text of any kind. If you want to smarten up the result by using special fonts, then you can do so by just marking the start and end of the highlighted section, and selecting a suitable style. There are even customisable short-cuts: you can set up your own key combinations to turn on particular effects (such as Sub-heading style etc.).

Impression also makes it as easy as possible to move around your document. You can use the scroll bars as normal, and when the pointer is at the edge of a frame, it turns into a hand, and by dragging this you can also "push" the document around the screen. Additionally, Computer Concepts will be implementing a means of stepping through a document one page at a time - though this was not yet implemented on my beta-test version. One of the many pop-up dialogue boxes lets you scale your document to any size. A 20% scaling factor gives a very useful overview. Moreover, it is possible to have multiple views of the same document.

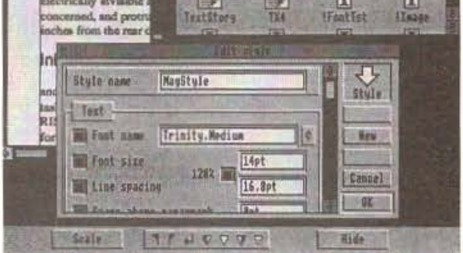
MEMORY CONSTRAINTS

As with all programs which use the anti-alias fonts, the ARC needs to load in and convert them to bit images as they are requested. This takes a finite time, and the first few characters typed can take some seconds to appear. Because of this you need to allocate as much free RAM to the Arc's font cache as you feel able (use the Task Manager - click Menu on the Archimedes icon at the bottom right of the icon bar). If you can only spare 32K or so, fonts will be reloaded into the cache every time that you scroll your document, and this makes life very difficult indeed. With 100K or so you are sitting pretty.

Computer Concepts claim that Impression can be used with ease on a 1Mbyte Archimedes, though as our review of Acorn DTP claimed, the same could hardly be said of that package. But Impression is very economical on RAM for such an extensive application - it is just 300K of code. This leaves a good deal of room for font caches, enhanced screen modes (Impression provides an array of these), and above all else, text and graphics.

TEXT AND PICTURE FRAMES

Impression is a frame-based document processor. Everything which finally appears on the paper must be placed within a frame. Each frame may contain either text or graphics. The latter may be either a sprite or a draw file from the RISC OS Draw application. It is not possible to mix these types, nor can you have more than one picture to a frame, but this is not a problem, since the number of frames per document is unlimited. As in Acorn DTP you can both crop and scale pictures with consummate ease using the mouse.



Style name MagStyle

Font name Trinity.Medium

Font size 14pt

120%

Line spacing 16.8pt

The style sheet editor

By clicking on 'View' in the frame editor, a neat frame border editor appears. This allows you to select one of a number of border types for the whole frame, or for individual frame edges. In this way you can easily create drop shadow boxes and the like. These can be used to very good effect in smartening up small documents such as a newsletter, or an advertisement for example.

Impression's frame-based approach gives great flexibility. Frames can be moved around the document, and resized at will by dragging with the mouse. By default, text within a frame is repelled by an overlaid frame so that placing a frame containing a bit image on the top of one or more text frames causes the text to flow around the picture, and the extent of repulsion on all sides is precisely definable. Text flows around frames with great ease,

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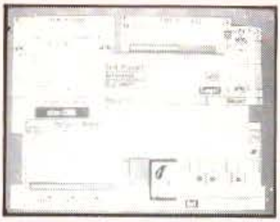

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as you type. You can also link frames at the click of a button so that text flows from one to the next. This will work automatically right through a document from column to column, and from page to page.

IMPRESSIONIST STYLES

The other major structural feature of Impression is its implementation of style sheets. Each style sheet defines not only a font and point size, but also tab settings, indents (including hanging or negative indents), justification, and leading (the line spacing). A number of styles are predefined, and it is an easy matter to define further styles to suit your needs. Using them is easy. To create a heading in a large typeface, you just mark the two ends of the heading using the mouse, then call up the Style menu, and click on Heading, say. The font applied to the marked portion of text will be that defined for Subheadings in the Style menu. You can also implement style changes as you type, by pressing certain preset key combinations.

Fonts can be set up in the Style editor to very great precision. You can define the font size of any given style from as little as 1/72nd of an inch to a massive full page for each character, and this is achieved to a resolution of 1/1000th of an inch. Impression is supplied with Acorn's three standard outline fonts: Corpus (similar to the Courier fixed space typewriter style font), Trinity (similar to the Roman serif font), and Homerton (similar to the Helvetica sans serif font). Each come in two styles: bold and medium. Users of Impression will also be able to make use of the new font packs which Acorn are planning to produce. Due for release from early 1990 will be packs containing New Century Schoolbook, Zapf Dingbats and others.

From within the Style menu access is also given to sets of faders which define the colours (or shades of grey) of both foreground and background. When the document is printed out on a mono printer, dithered dot patterns are used to create an equivalent shade. The faders also have a percentage readout, and it is an easy matter to create say a 61% grey tone.

The great advantage of Impression's implementation of style sheets is that you can change the typesize of all subheadings in a document by editing the sub-heading style. Unfortunately however, you cannot make adjustments to features such as font size *without* them being defined on the Style menu. For example, if you want to adjust the type size of a particular piece of marked text, you will need to go to the Style editor, and set up a new style first. There is no way to override this feature for one-off changes.

The same goes for tabs and indents which are set up on the ruler associated with each style. Again this is very easy to set up, but if you want to change to a different set of tab settings halfway through a document, say for a table, and then go back to the old ones, you must define a new style for this part of the document. To be fair to Computer Concepts, the way is considerably eased by allowing elements of a style to be "invisible". Thus you could define a style called "40 point" which would alter the point size of any text to 40 point, but leave all other features, including even the name of the prevailing font, unaltered.

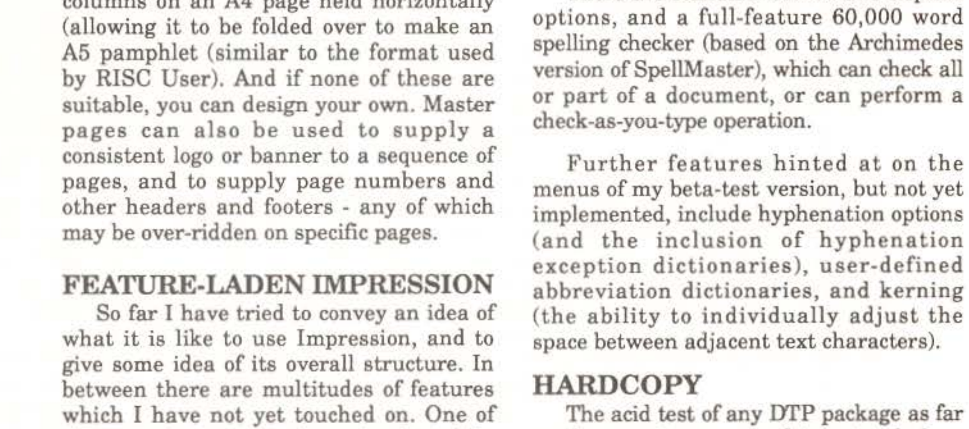
MASTER PAGES

Computer Concepts describe Impression as a Document Processor. Each document consists of one or more Chapters. Each chapter consists of one or more pages, and each page of one or more frames. As suggested earlier, you can place frames exactly where you need them, and move them around at will. But the effects which you create will only be valid for the current page.

To allow for conformity from page to page, Impression uses the concept of Master Pages. At the beginning of each new chapter (the start of a single page memo still counts technically as a new chapter), you can select an appropriate master page. The simplest has a single A4 sized frame, another has a two-column format, while yet others allow four columns on an A4 page held horizontally (allowing it to be folded over to make an A5 pamphlet (similar to the format used by RISC User). And if none of these are suitable, you can design your own. Master pages can also be used to supply a consistent logo or banner to a sequence of pages, and to supply page numbers and other headers and footers - any of which may be over-ridden on specific pages.

FEATURE-LADEN IMPRESSION

So far I have tried to convey an idea of what it is like to use Impression, and to give some idea of its overall structure. In between there are multitudes of features which I have not yet touched on. One of the very impressive, but simple tricks which it performs with ease is dragging text and graphics around. You can open a directory viewer and simply drag a text file or sprite across to a frame, and it will be installed; while dragging a document file to the Style editor will append the styles which it contains.



24 pt Homerton Bold (Heading

18pt Homerton Medium (Sub-heading Style

14 pt Homerton Bold (Bold Style)

14pt Trinity Medium (Defa

12 pt Trinity medium

24 pt Homerton Bold (Heading

18pt Homerton Medium (Sub-heading Style

14 pt Homerton Bold (Bold Style)

14pt Trinity Medium (Default Text Style)

12 pt Trinity medium

The quality of output depends on the type of printer used: compared here, are a 9-pin dot matrix (top), and a 300 dpi laser printer

A Cut and Paste feature lets you do the same with sections of text and graphics within a document. Items can be marked with the pointer (a click at each end), and then Cut or Copied to a Clip Board, from where they may be Pasted back into the document at any time.

There are standard Search and Replace options, and a full-feature 60,000 word spelling checker (based on the Archimedes version of SpellMaster), which can check all or part of a document, or can perform a check-as-you-type operation.

Further features hinted at on the menus of my beta-test version, but not yet implemented, include hyphenation options (and the inclusion of hyphenation exception dictionaries), user-defined abbreviation dictionaries, and kerning (the ability to individually adjust the space between adjacent text characters).

HARDCOPY

The acid test of any DTP package as far as the user is concerned is not only how easy it is to use, but what the end product looks like. Impression makes full use of Acorn's printer drivers to achieve first class results, and the latest versions of these are supplied with the package. These include Epson, Integrex colour, Postscript and LaserJet formats.

Before you can print anything, you must install on the icon bar the driver appropriate to your printer. Clicking on Print from the Document menu then brings up a dialogue box offering various options. Once your selections have been made, printout begins.

Of course the final result will depend on the quality of printer that you use. But with Acorn's new printer drivers even the humble 9-pin dot matrix printer gives a tolerable output, as you can see from the figure. But the best results are obtained from a laser printer, and both Hewlet Packard LaserJet, and PostScipt types are catered for. Using 300 DPI resolution, Impression can create extremely good looking proofs. On the text, you need to look very hard to find the dot structure, and Draw files also look good. The quality of bit images is very dependent on where they come from. But you must remember that true photographic quality is not possible, since laser printers have no grey scale. Grey pixels in an image must be represented by a scattering of small black dots. Even so the results are far from disappointing.

CONCLUSION

Overall, Impression is a very powerful DTP package with hosts of features. With the proviso about the restrictive use of styles, it is exceedingly easy to use, and produces excellent results, both on screen and on paper. The program is very compact, permitting large documents and sizeable bit images to be held in memory even on a 1 Mbyte machine. It can also be used in 'memory saving' mode, automatically keeping all but the current chapter of a document on disc.

If you are trying to decide between Impression and Acorn DTP, and you only have a 1 Mbyte machine, then there is really no choice. Similarly, if you want to be able to use the package as a word processor, then Impression wins again - since Acorn DTP does not offer word processing facilities. The only major feature offered by Acorn DTP and not by Impression is the ability to draw directly into a frame. But since you can drag Draw files directly into an Impression frame, (and you can even multi-task Draw with Impression if you want), this does not represent a problem.

Finally, if the product has not been released by the time that you read this, and you are desperate for a copy, Computer Concepts will supply you with a pre-release version, which they will upgrade free of charge when the time is right.

Product	**Impression**
Supplier	**Computer Concepts Ltd. Gaddesden Place Hemel Hempstead, Herts HP2 6EX. Tel. (0442) 63933**
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Into the Arc - Getting the most from Draw

by Mike Williams

In this month's article in our series *Into the Arc*, we shall move even further away from the realms of programming to look at one of the major programs supplied with every Archimedes (and A3000), the *Draw* application. This is a powerful program, either in its own right, or for creating and incorporating drawings directly into word processors, DTP packages and the like.

As with other applications, double-clicking on its icon in the directory viewer (Draw is on Applications Disc 1) will install it on the icon bar. Once installed, clicking on this icon will open a draw window ready for work.

The new User Guide, now supplied as standard with the Archimedes, devotes some 45 pages to Draw, but nevertheless it is very easy when first investigating this application to get thoroughly confused, and to give up all together. This is a shame as Draw is quite powerful, and will become more and more useful as time goes by to create all manner of drawings and diagrams to be incorporated into other documents using word processors and desktop publishing systems. Hopefully, this article will ease you over the threshold as far as Draw is concerned.

Draw differs in one fundamental respect from the Paint application: Draw is used to create *objects*. Objects can become quite complex, but it is always possible to identify, and hence edit, any previously created object. Contrast this with Paint. This is pixel based, meaning that any item you create on the screen is just a collection of coloured pixels. There is no way that Paint can recognise an object which you have created in the same way as you can with Draw. This difference is more generally applicable and distinguishes most painting and drawing applications.

CREATING SIMPLE OBJECTS

The Draw window differs from many in that a set of nine *tools* is normally displayed at the left-hand side of the window. Most simple drawing tasks can be accomplished by selecting the correct tool first. If you want to change the characteristics or style of any object (such as thickness or colour of a line), or if you want to edit the drawing you are working on you will need to press the Menu button to bring up the main Draw menu, similar to other applications.

The first five tools (counting from the top) are all related together, and are used to construct objects made up of straight or curved lines. To draw a sequence of lines the Select button is pressed once at the start, and at each subsequent point in the chain of lines until the last point is reached, whereupon the Select button should be pressed twice in succession to terminate the current object. Do NOT use either the Menu or Adjust buttons at this stage as this will only confuse.

Straight line segments are drawn by rubber banding - once one point is fixed, moving the mouse causes a line to be displayed from that point to the current position of the mouse until fixed by pressing Select. The first *tool* is used for open objects, the second for closed objects - when you double click on your last point, Draw automatically connects it to the first point of that object.

If you haven't done so already it is worth practising and mastering the use of these two tools before proceeding further. One important facility which may not be obvious is how to delete your drawings to start afresh. Press the Menu button and follow the *Select* option to *Select All*. Now repeat this, but select the *Delete* option to clear the screen. Another useful way of

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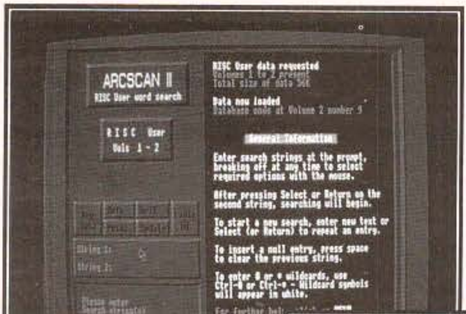

RISC User data requested
Volumes 1 to 2 present
Total size of data 56K

Data now loaded
Database ends at Volume 2 number 9

General Information

Enter search strings at the prompt, breaking off at any time to select required options with the mouse.

After pressing Select or Return on the second string, searching will begin.

To start a new search, enter new text or Select (or Return) to repeat an entry.

To insert a null entry, press space to clear the previous string.

To enter # or * wildcards, use Ctrl-# or Ctrl-* - Wildcard symbols will appear in white.

For further hel;

ArcScan II contains the following databases:

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BEEBUG Volumes 1 - 8
The Indexes to the following Archimedes Acorn manuals:
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Programmer's Reference Manual (Arthur)
RISC OS User Guide
RISC OS Basic Manual
RISC OS Programmer's Reference Manual

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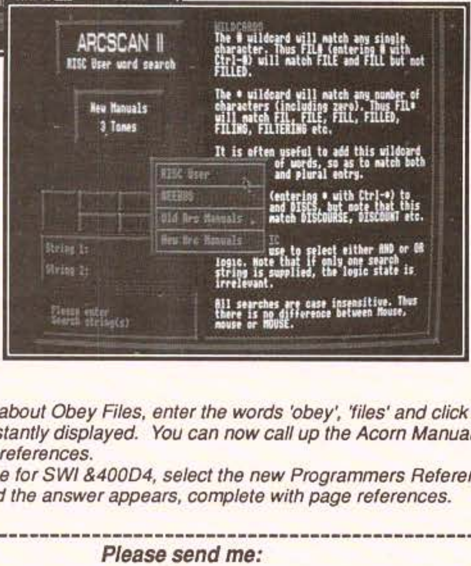

WILDCARDS
The # wildcard will match any single character. Thus FIL# (entering # with Ctrl-#) will match FILE and FILL but not FILLED.

The * wildcard will match any number of characters (including zero). Thus FIL* will match FIL, FILE, FILL, FILLED, FILING, FILTERING etc.

It is often useful to add this wildcard of words, so as to match both and plural entry.

(entering * with Ctrl-*) to and DISCS, but note that this match DISCOURSE, DISCOUNT etc.

IC
use to select either AND or OR logic. Note that if only one search string is supplied, the logic state is irrelevant.

All searches are case insensitive. Thus there is no difference between Mouse, mouse or MOUSE.

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1. If you need to know about Obey Files, enter the words 'obey', 'files' and click on the AND logic. All finds in RISC User will be instantly displayed. You can now call up the Acorn Manuals indexes and repeat the search to get further references.

2. To find the SWI name for SWI &400D4, select the new Programmers Reference Manual from the menu, enter "SWI &400D4", and the answer appears, complete with page references.

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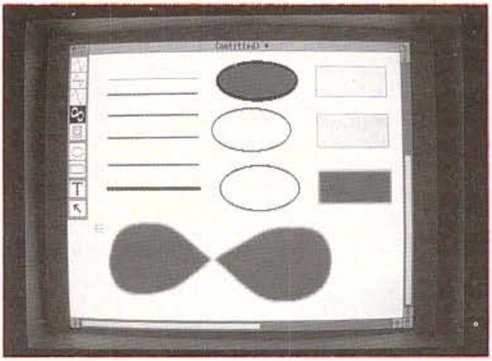
getting out of trouble is to press Escape - this will abort any current drawing activity, and all the lines of your uncompleted object will disappear. This is very helpful if you find that rubber banding is tying you up in knots.



Editing curves using control points

Curve drawing is similar to straight line drawing, but seems more complicated as each curve has not only two end points, but also two *control points.* Pressing Select positions the end points only - Draw automatically adds the control points, but these can easily be adjusted later. Again there are two versions of this tool, one for drawing open curves, one for closed curves.

The simplest curve is achieved by selecting the first of the two curve drawing tools, pressing Select to mark the start point, and then Select again *twice* to mark the end point. The result will be only very slightly curved. However, move the star pointer to any point on the curve and press *Adjust.* The two end points, and the two control points will now be displayed, and the star pointer changes to the more usual arrow. Use the Adjust button to drag either of the control points, or the two end points to new positions until the shape and position of the curve is to your satisfaction. Press Select, and the highlighted points disappear leaving the completed curve. Of course, you can reselect the curve for further adjustment as many times as you like.

The last of the five basic drawing tools can only be understood in the context of the use of the first four. We have already seen that line segments can be linked together to form an *object.* Segments can also be mixed (curve or straight line) simply by selecting a different tool when required. When constructing an object, a need often arises for moving from one point to another without drawing a line, but still continuing as part of the same object. This is what the fifth tool achieves - it is like including an invisible line segment in your object.

SIMPLE EDITING

I have already mentioned the use of the Adjust button to select a curve and adjust its end points and control points. The same procedure can be used with any object however many segments it is constructed from, and all the points so highlighted can be moved and adjusted at will.

RECTANGLES AND ELLIPSES

Two further tools allow the drawing of rectangles and ellipses (including circles). Both of these tools are straightforward and simple to use, but note that if subsequently edited there is nothing to prevent either shape from being distorted (a rectangle to any shaped quadrilateral, an ellipse to any shaped curve) - they are both just short cuts avoiding the more extensive and difficult use of the tools previously described.

REMAINING TOOLS

There are two further tools, at the bottom of the tool display. The first, indicated by a large letter 'T' is for text entry. Any text entered also constitutes an object as far as Draw is concerned. Once selected, use the mouse to position the text caret for text entry. Use the *Style* option from the main Draw menu to select such attributes as font, size, colour etc. before entering any text. Note that text once entered cannot be edited, only removed and replaced.

The last tool, marked with a solid-looking diagonal arrow is the *select* tool. This enables individual objects to be selected for further work. A simple example - if you have created two or more distinct objects on the screen, use the this tool to select one of these objects (by choosing the select tool and then simply pressing Select while over or within the required object). This can now be deleted using the *Select* option in the main menu, leaving any other objects intact. Selected objects can also be moved around on the screen.

If you have many objects, or several objects close together, care may well be needed in positioning the mouse in order to choose the correct object. Successive double-clicking may sometimes be needed to isolate the right object. Objects can also be selected using the select tool, by using the Select button to *drag* a rectangle to enclose the object.

MORE ADVANCED EDITING

In general, you can either manipulate an object as a whole, or you can edit the components of an object. To treat the whole object it must be selected by one of the methods described above, and will be shown on the screen enclosed in a (normally) red dashed rectangle. An object so marked can be moved about the drawing area by dragging it with the Select button.

The enclosing rectangle has two so-called *ears*, one at top right, and one at bottom right. The former can be dragged (with the Select button) to rotate the object, while the other can be similarly used to scale the object. By using scaling to turn the object 'inside out' it can also be reflected vertically or horizontally.

The *Select* option in the main menu can also be used to choose from a further variety of functions which are applied to the object as a whole, including copying and deletion as mentioned before. The *Select* menu also includes an *Edit* function which selects the components of the object. This is an alternative to the use of the Adjust button to highlight components.

Once all the segments in an object have been marked on the screen, then the positions of all points can be adjusted as previously described. In addition, provided that a line or curve segment has been selected (it will be shown in red), pressing the Menu button brings up the *Edit* menu. Segments can be deleted, points added, curves changed to lines and vice versa, and other functions carried out.

STYLING OBJECTS

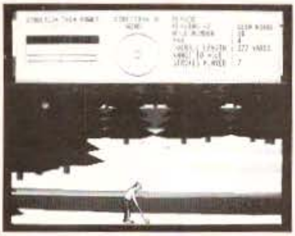
I have concentrated so far on the methods of drawing and constructing objects, all of which is very important if you are going to make the most of this powerful application. Assuming that you have followed me so far, and have practised what I have described, we can begin to add more interest to the wireframe objects so far seen.

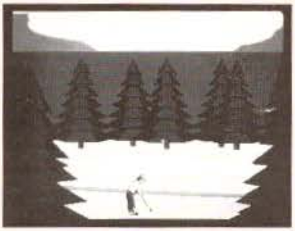
All objects, from the simplest line, have associated with them a variety of characteristics which determine the style in which they are displayed. Many of these features are determined by the *Style* option in the main Draw menu. For example, there are six preset choices for the thickness of a line, or you can specify your own.

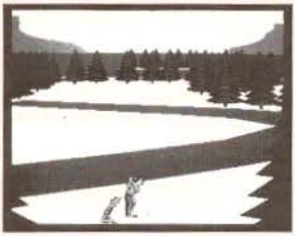
You can also specify a *line* colour and a *fill* colour, either by selecting a colour from the default palette when displayed, or by using the usual slider bars to mix a colour of your own choice. Do remember to

Continued on page 55

HOLED OUT !!







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REVIEWS

"In the June issue of the Micro User, Holed Out for the BBC Micro was described as a test of skill not to be missed. The same game has now been released for the Archimedes and it is quite a stunning piece of work, ranking with Zarch and Conqueror in quality.....The graphics are effective and have amusing little touches like the ripples when the ball hits the water and sand flying into the air when you are trying to get out of a bunker.....a great game." **THE MICRO USER August '89.**

"Sound is definitely a feature of Holed Out. There are samples for all sorts of situations: hitting trees, splashing into water, dropping into the hole and of course whacking the ball." **ACORN USER August '89.**

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Making Backups

Lee Calcraft presents some hints and tips on saving and backing up files.

Whether you are entering text on a word processor, or developing a program, it makes sense to save your work at reasonably frequent intervals. If the power is unexpectedly cut off, or the computer hangs up, or if you switch off your machine unintentionally, frequent saves will minimise your losses. It is also prudent to back up your work onto a second medium (e.g. a separate back-up disc) before you kill off the copy in RAM in your machine. In that way, you always keep two copies of your work against the time when your disc goes down.

Another approach is to make back-ups of all new files at the end of the day. This approach is often adopted by hard disc users, and special backing-up software (such as that released by BEEBUG) will automatically back up files created after a given date. If you do not have such a utility, you could use the Desktop, and just drag the files to your back-up disc as required. But this can be tedious, and doubly so if you only have a single drive. To speed up the process, you could use the RAM disc, dragging files to the RAM disc directory viewer, then opening up a directory viewer on the back-up disc, and dragging files to it from the RAM disc. For further information on using the RAM disc, see RISC User Volume 2, Issue 5 page 31.

If you make bulk back-ups, then it is prudent to rotate your back-up discs on a scheme such as the so-called "grandfather-father-son" scheme. Here you would typically keep three sets of end-of-the-day back-ups from consecutive days. On the fourth day, the grandfather (the oldest back-up) would be re-used, becoming the son, and so on. Additionally it is prudent to make more permanent, or 'Archive' back-ups at intervals of say once a month. All this may seem like a lot of effort, but it is nothing compared to the effort of re-writing lost documents and programs.

USING PROPRIETARY SOFTWARE

When using proprietary software, whether this be the Basic program editor, Twin, or a Desktop application such as Draw, you can always save a back-up file by altering the drive name or number supplied in the *save* box. From the Desktop this is a little tedious, and in any case, alters the current filename to include the back-up path so that when you click on save again, you are presented with the back-up save path, and must re-edit this for a normal save.

It is easier in the Basic Editor, where you can simply insert the back-up drive number or the disc name preceded by a colon in the filename box. With Twin, press F3 to *save,* then enter the back-up drive number preceded by a colon, and then press the *copy* key to supply the rest of the filename.

AUTOMATED BASIC SAVES

Because of the importance of frequent file saving and back-up taking, it is a good idea to automate the process. When using Basic, it is very easy to do this. To start with, you can hold the filename of a program in the first REM line, as follows:

```
10 REM  >MyProg
```

If you type SAVE at any time, the program will be automatically saved to the currently selected directory under the name in the REM line - *MyProg* in the example.

To further automate this, set up a function key with the word SAVE in it. For example:

```
*KEY 1 SAVE|M
```

This will set up function key F1 to perform a save, every time that you press it. The |M tells the operating system that there is a carriage return after the SAVE, and the | character is entered using the key immediately above the Return key.

If you have a hard disc, you may find it useful to expand this key definition to:

```
*KEY 1 SAVE |M SOUND 1,-10,70,1|M
```

This will generate a beep if the *save* key is pressed (without it, you will not always be sure that the save was performed).

AUTOMATED BACK-UPS

The EXEC file in the accompanying listing provides a simple way to automate the backing up of Basic programs. It may be entered using Edit (click Menu over the Edit icon on the icon bar, and select "New Command File"), and should be saved under the name PB (Program Back-up) in the Library directory of your work disc (i.e. $.LIBRARY). Note when entering this command script that it uses various tricks such as calling VDU21 to blank the screen, and a line containing just the letter "Z" to set Basic's error number to a known value.

Once the script has been saved, whenever you type *PB, it will back-up the program in memory to a disc named BackUp. It reads the filename from the first REM line of the program, and saves the file to the directory $.Backup. If no disc named BackUp is present, an error will be signalled. If the disc is present, but contains no directory called BackUp, then one will be automatically created.

This auto-back-up command script has one further trick up its sleeve. If you are developing Desktop applications, your main program will in all likelihood be called !RunImage. Clearly the back-up directory can only hold one file with this name. So if this name is encountered in the first REM line of your program the back-up code looks for an alternative name supplied in a second REM line, and uses this. For example if the top two lines of your program are:

```
10 REM >!RunImage
20 REM >Image2
```

the program will be backed up using the name *Image2*. If there is no appropriate second REM line, the name !RunImage is used, but a beep and a screen warning are given.

To further automate the backing up process, you could set up function key 2 to initiate the save as follows:

```
*Key 2 *PB|M
```

Finally, note that there should be no spaces between the ">" character and the start of either filename.

```
*| >PB
*| Program Backup
VDU21
Z
P%=PAGE
REPEAT P%+=1:C%=?P%:UNTIL C%=ASC(">") OR P%>PAGE+40
IF C%<>ASC(">") VDU6:P.TAB(10)"*** File name not found ***":VDU7,21:OS.("FX12
5"):VDU6
*FX15,1
IF $(P%+1)="!RunImage" THEN Q%=P%:REPEAT P%+=1:C%=?P%:UNTIL C%=ASC(">") OR P%
>PAGE+80:IF C%<>ASC(">") THEN P%=Q%:VDU6:P."Saving as !RunImage":VDU21:SOUND
1,-10,200,3
S$=":Backup.Backup."+$(P%+1)
VDU6:P.TAB(10)"SAVING ";S$:VDU21
SAVE S$
IF ERR=67798 VDU6:P."Creating new directory":VDU21:OS.("CDIR :Backup.Backup")
:OS.("PB")
VDU6:IF ERR<>4 THEN REPORT:VDU7,13,10
```

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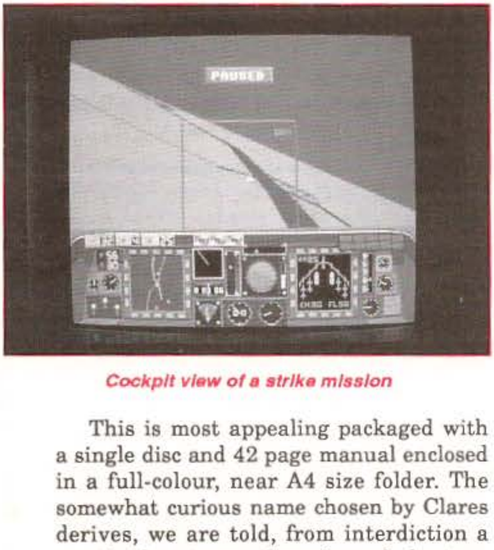
Seek and Destroy

Clares' Interdictor reviewed by Mike Williams

Flight simulators from World War II fighters through to modern jumbo jets have long enjoyed a vogue on many different micros. Indeed, such products with their obvious links to real flight simulators used for pilot training, bring a cachet of respectability beyond the reach of most mere games. With its power and graphics capabilities, the Archimedes seems an ideal host for such a program, and Clares Micros has obliged in the form of Interdictor.



Cockpit view of a strike mission

This is most appealing packaged with a single disc and 42 page manual enclosed in a full-colour, near A4 size folder. The somewhat curious name chosen by Clares derives, we are told, from interdiction a particular type of seek and destroy mission.

Each time Interdictor is run, you are asked to identify colours in specified positions in a printed mosaic as a form of security, a method I haven't seen for some while. It becomes a bit tedious having to go through this particular hoop each time the game is loaded (but you can play - sorry fly - as many times as you wish once Interdictor is up and running). Although Interdictor can be run from the Desktop, it is not multi-tasking, and users are warned to close down other applications first for safety.

The screen display shows all the expected cockpit controls in the lower part of the screen display with the pilot's view out of the plane above, and superimposed upon that the so-called Head Up Display or HUD) which provides an artificial horizon. The instrument panel is quite daunting, but the manual provides a flying tutorial which keeps everything as simple as possible. Indeed take off is simplicity itself - get up speed, back on the controls (the mouse) and up the plane goes. From then on life starts getting more complicated.

My first few attempts (indeed all my attempts to date) have eventually resulted in my crashing the plane, either through poor control or simply through running out of fuel before I could land, always a tricky manoeuvre. The landscape is quite realistic and more detailed than I have seen before, and after about six attempts (it might have been more) I was able to locate and destroy my first practice target, a bridge over a road (and then I crashed). A barge on a nearby river, and a remote control aircraft provide additional practice targets.

There is a scenario to Interdictor, which involves following a river valley, capturing enemy airfields at which you can then land and refuel while avoiding or combating enemy fire from the ground and the air. The game is complete when you capture enemy headquarters at the head of the valley.

Interdictor does not simulate any specific real life fighter, but that in no way detracts from the realism. The aircraft is fully equipped with all the expected controls and instruments to be found in a modern fighter plane, and is fully armed with rockets, cannon and missiles. All aspects of the environment are realistically portrayed. Girder bridges can be flown over or under (or even through if you have the nerve), and trucks may be seen driving across bridges tipping as they hit the ramps on either side. A special joystick is also available for use with Interdictor, though I found at first that this made control more difficult, but more responsive.

Clares has done an excellent job in producing Interdictor. My only disappointment is in the sound effects, which I felt were less than impressive. That apart, Interdictor will test your concentration to the limit and keep your eyes glued to the screen. In my view it is a little overpriced, but it should sell well, particularly to A3000 users, and further enhances the variety and quality of software available for the Archimedes range.

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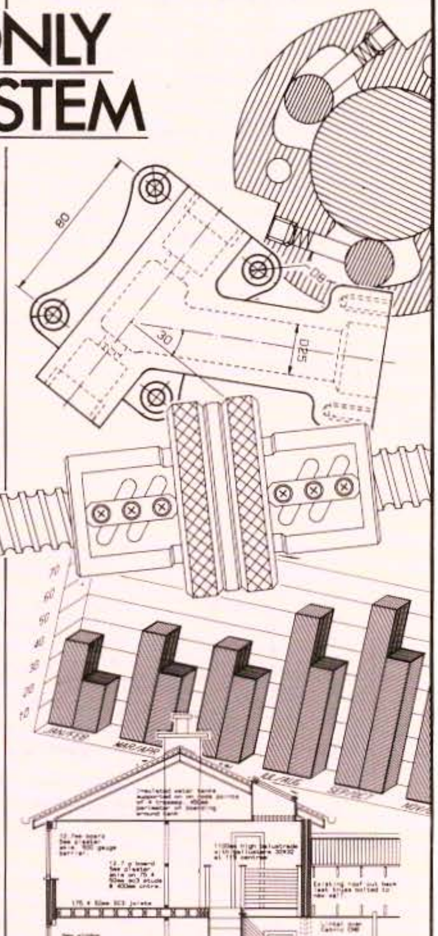

Under the Lid

Part 2

David Spencer continues his look at the hardware that makes up the Archimedes.

After last month's general introduction to digital electronics, we will be concentrating this time on two of the chips making up the ARM chipset. These are the ARM processor itself, and the memory controller, MEMC.

ARM WRESTLING

The ARM chip (Acorn RISC Machine) is the micro processor which is the key to the power of the Archimedes. This device, which was developed in-house by Acorn, uses a number of powerful techniques that make it execute instructions very quickly - however, its basic functioning is little different from that of any other microprocessor. The ARM continually fetches instructions from memory and executes them. It does this by placing the address of the instruction (held in the program counter register) onto the address bus, asserting a number of control signals to indicate that it wishes to read an instruction, and then reading the instruction word from memory using the data bus. What is involved in executing the instruction depends on the individual instruction. For operations such as ADD or MOV the process is performed internal to the ARM using its built-in registers. On the other hand, a load or store instruction will place another address on the address bus, assert the appropriate control signals, and either read the data in for a load, or place the data on the data bus for a store. The whole process is then repeated ad-infinitum until the computer is turned off.

On its own, the ARM processor is like a fish out of water. It needs so-called *support circuitry* to control both its own internal functioning, and its accesses to memory. This is the job of the second custom chip - the memory controller MEMC. We will look at this in some detail shortly, but for the time being it is sufficient to know that one of the signals it produces is a *clock* for the processor. This isn't the type of clock you can tell the time by, but rather a signal which oscillates between logic '0' and '1' at regular intervals. It is common practice in digital circuits to use some form of clock to synchronise all the individual elements of the system. In such a *synchronous* system, all actions are performed in response to the change of state of the clock. For example, the clock changing from '1' to '0' could be used to trigger writing a word of data into a memory location. The alternative is an *asynchronous* system in which every element works at its own speed, independently of all the others. This can be compared with all the cylinders in a car engine firing in their own time, rather than following a well defined sequence - absolute chaos would result!

The ARM in fact uses two clocks, called Ø1 (phi 1) and Ø2 (phi 2). However, the system is arranged such that when one clock is at logic '0', the other is at logic '1' and vice versa. Both of these clocks are derived by MEMC from a master clock input which comes from an oscillator based around a quartz crystal vibrating at 24MHz (24 million cycles a second). Although the master clock runs at a constant rate, the clocks into the ARM itself vary in rate. This is because the ARM is capable of running much faster than other parts of the system, notably the memory and input/output devices, and MEMC has to keep it in check by slowing it down at the appropriate times. We will explain how this is done shortly.

MEMORY ORGANISATION

We have already seen one role of MEMC - its function in controlling the clocks to the ARM. However, a much more important function, and the one which gives it its name, is that of controlling accesses to memory. The twenty-six line address bus of the ARM allows up to 64Mb of memory to be accessed, and the layout of this so-called *address space*, or *memory map*, is shown in figure 1. One point to note is that although memory addresses are quoted as byte addresses, the Archimedes organises its memory into 32-bit words, four bytes side by side. For all operations except byte store instructions (STRB), memory is always accessed in word-sized chunks.

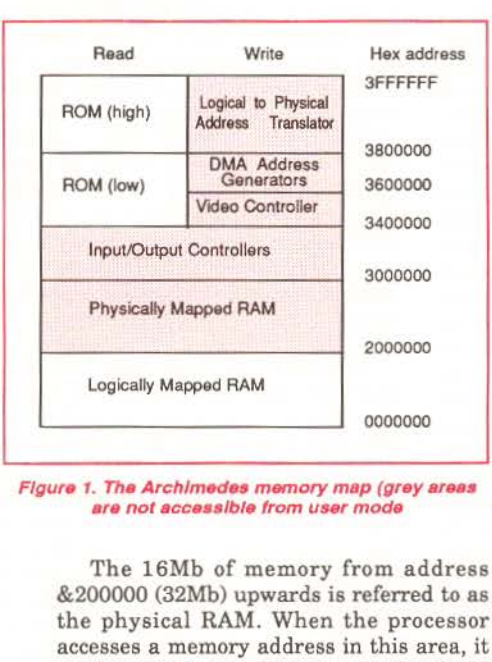

Figure 1. The Archimedes memory map (grey areas are not accessible from user mode

The 16Mb of memory from address &200000 (32Mb) upwards is referred to as the physical RAM. When the processor accesses a memory address in this area, it reads or writes a location in the RAM directly. Obviously there will never be as much as 16Mb of RAM in a standard Archimedes. In fact, MEMC imposes a limit of 4Mb, and in practice the physical memory is repeated as many times as is necessary to fill the 16Mb area. For example, in an A440, the first word of memory appears at address &200000, but also at addresses &240000, &280000, and &2C0000. Normally, only the lowest possible address for a location is used.

While it would be perfectly acceptable for the ARM to directly access the physical RAM, this is not done. Instead, a more advanced system of logical memory is used. To understand how this works, consider the physical RAM being split into 128 equally sized chunks, called pages. The size of these pages depends on the amount of RAM in the machine, and will be 32K for a 4Mb system, 16K with 2Mb, and 8K on a 1Mb machine. On an A305, the page size is kept at 8K, and only half of the possible pages are used. The bottom 32Mb of the address space, called Logical RAM, can then be divided into a number of slots, each being the same size as the RAM pages. The size of each slot depends on the page size, and table 1 shows the relationship between amount of RAM, the page size and the number of logical slots.

RAM size	Page size	No. of slots
0.5Mb	8K	4096
1Mb	8K	4096
2Mb	16K	2048
4Mb	32K	1024

Table 1. Memory page size relationship

MEMC provides a mechanism by which each of the 128 pages of RAM can be made to appear in any particular slot. In the simplest case, you could map all the pages into contiguous slots at the bottom of the memory space, making the layout of the logical RAM exactly the same as that of the physical RAM. Alternatively, though, you can use the approach adopted by RISC OS in which clusters of pages are placed at defined points throughout the memory map, with each cluster being put to a particular use. For example, the relocatable module area consists of a number of pages mapped to start at address &1800000, while the cluster of pages used for the screen display is arranged to end at address &1FFFFFF. This system also makes possible the switching of tasks in the multi-tasking environment of RISC OS. The memory used for each application is defined to start at address &8000. To achieve this, RISC OS allocates a number of physical pages to each application, and when a particular one is being executed, the memory mapping is altered so that its pages appear at address &8000 upwards. Meanwhile, the pages belonging to the other applications are kept well out of the way, in an area of the logical RAM which is not normally used.

Obviously, with as many as 4096 slots, and only 128 pages of RAM, there will be many slots which are not mapped to any real memory. What does MEMC do when one of these is accessed? Rather than returning a false value, MEMC activates an Abort signal which is fed back to the ARM. The ARM detects this, and the operating system generates a fatal error - Abort on instruction fetch or data transfer in the case of RISC OS. To try this out, enter:

```
PRINT ?&FFFFFF
```

from Basic. This address will never be mapped to any memory, and will therefore cause an abort error. The address given with the error is the address of the instruction within the Basic interpreter which attempted the load, not the memory address from which the aborted read took place.

Aborts can also occur in another situation. MEMC allows individual pages of memory to be protected, such that they cannot normally be accessed. The ARM processor can operate in one of four modes. SVC mode used for the operating system, and IRQ and FIQ mode used while handling interrupts, are known as privileged modes, and can freely access all of the memory map. The fourth mode is termed User mode, and is the mode used to execute most applications. The operating system can choose to restrict access to certain pages in user mode, so that they can be read but not written, or not accessed at all. If an illegal access is attempted then an abort will occur. RISC OS uses this technique to protect the pages of memory used for the RAM disc, among others.

Internally, MEMC implements the paging of memory by using a very fast 128-entry memory called a Content Addressable Memory (CAM). There is one entry per page of RAM, and each entry holds the slot number associated with that page. When the ARM tries to access an address within the logical RAM, MEMC derives the slot number from the address, and looks up that number in each of the 128 CAM entries simultaneously. If a match is found then a further check is made to ensure that the access is not protected against. If everything is OK then a physical RAM address is formed from the page number and the offset within the slot of the original address. The name CAM arises from the fact that the memory is being operated in reverse, with an address being found from the contents, rather than vice versa - hence Content Addressable.

CONNECTING THE RAM

MEMC holds a final trick up its sleeve connected with RAM access. In an A440, there is 4Mb of memory arranged as 1M words. Normally this would take a twenty signal bus to address, because 2^{20} is 1M. However, the dynamic RAM used in the Archimedes, and most other computer systems, uses a bus with only half as many bits. The full twenty bits of the address are given to the RAM chips in two ten-bit chunks. Internally, the memory is organised as an array, with one ten-bit address choosing the appropriate row, and the second the column. In a normal computer system each address from the processor would be split into column and row addresses for the RAM, and both would be fed into the RAM chip. However, MEMC uses this split addressing to implement a speed-up technique. Having fed a row address into the RAM, and selected a particular row, any column within that row can be accessed with only a column address. Feeding only half of each address into the RAM is roughly twice as quick as feeding the entire address, and hence offers a substantial overall speed increase. This system is known as paged mode access, and must not be confused with the memory paging described above.

MEMC implements paged mode access by performing a single full memory access by three accesses in which only the column address is passed to the RAM, the row address remaining unchanged. The reason why a full memory access is used every four cycles will become apparent next month when we look at direct memory access. Clearly, a full memory cycle takes longer than a column only access, because two addresses must be fed into the RAM. To allow for this, MEMC slows down the ARM during a full access by holding the Ø1 clock input at a logic '1' level until the row address has been fed into the RAM.

THE REST OF THE ADDRESS SPACE

So far we have concentrated on the logical and physical RAM areas of the memory map. The next area of the map, the 4Mb from address &3000000 upwards, is used by MEMC to access the Input/Output controller, IOC, and other I/O devices, and we will come back to this next month. The rest of the memory map is split into separate sections for reading and writing. Reading accesses one of two areas of ROM, of which only the high ROM area is used in the Archimedes. Writing to this area will either access the video controller, VIDC, which again will be covered next month, or registers internal to MEMC itself. The processor address bus is not connected to MEMC, instead, data to be written to the memory controller is encoded into the address lines. The whole area between addresses &3800000 and &3FFFFFF is used to program the CAM to set the mapping between logical and physical memory.

Next month we will conclude our study of MEMC by looking at Direct Memory Access (DMA), and move on to look at VIDC and IOC. RU

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Mastering the Wimp

Part 3

Creating Windows (continued)

by Lee Calcraft

This month we continue with the task of identifying the multiplicity of elements in the SWI call "Wimp_CreateWindow". In this pursuit we will be referring to the table of call parameters given last month, and to the demonstration program listed the month before. We shall be concentrating on three sets of Wimp flags which occur in the parameter block, but first of all there are two remaining sets of co-ordinate parameters as yet untreated: the scroll offset, and the minimum window dimensions.

THE SCROLL OFFSET

At block%+16, and block%+20 of the parameter block (see figure 2 from last month), the x and y scroll offsets must be supplied. These are 32-bit words giving the relationship between the visible area and the work area. The two offsets are usefully defined as the co-ordinates in the work area of that pixel which is displayed at the top left-hand corner of the visible area.

In the demonstration program, these two offsets were given as zero. This results in the top left-hand corner of the visible area coinciding with the origin of the work area - which, in our program, is the top left-hand corner of the work area. When you run the program you will see this confirmed by the position of the scroll bars. The horizontal one is at the extreme left, and the vertical one at the top of its range.

If we supply a horizontal scroll offset of 100 (at block%+16), then the left-hand edge of the visible area will be 100 graphics units from the left-hand edge of the work area (see figure 1). Similarly, if we set the vertical scroll offset (at block%+20) to -200, the top of the visible area will be 200 units below the top of the work area. We need to use a negative value because the origin of the work area (from which the scroll offset is measured) is at the top left-hand corner of the work area. The values 100 and -200 are of course just the starting values of the two scroll offsets. Both may be adjusted to any value using the scroll bars.

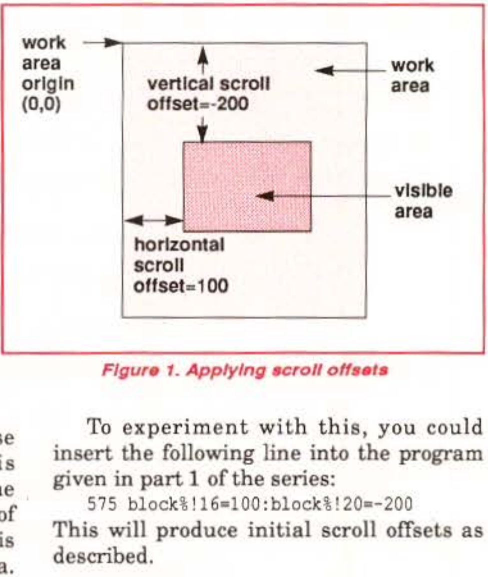

Figure 1. Applying scroll offsets

To experiment with this, you could insert the following line into the program given in part 1 of the series:

```
575 block%!16=100:block%!20=-200
```

This will produce initial scroll offsets as described.

MINIMUM WINDOW SIZE

By dragging the *adjust size* icon at the bottom right-hand corner of scrollable windows the user can adjust the size of any window. The minimum size attainable is taken from the two 16-bit parameters at block%+68 and block%+70. If these are set to zero (as they are in the test program from part 1 of the series), the default for both is taken to be the width of the title string. You can verify this by dragging the *adjust size* icon on the test program. Try

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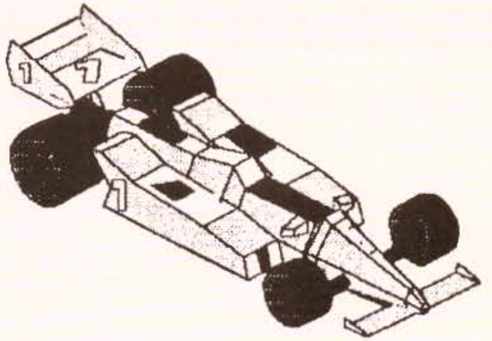

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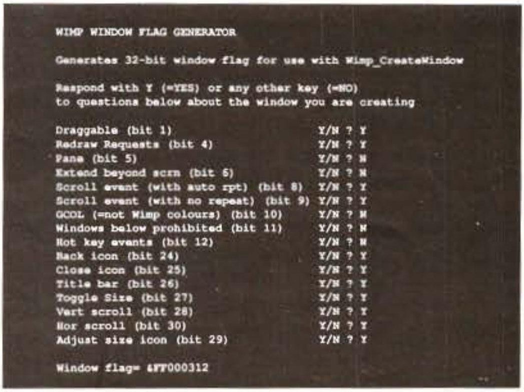
also supplying different minima. A line similar to the following will do the trick:

```
745 block%!68=300+400<<16
```

The contortions in this line serve to place the value 300 at block%+68, and 400 at block%+70 - the "<<16" at the end means shift the value 400 to the left by 16 bits. This is necessary since although Archimedes Basic has single-byte and four-byte indirection operators ("?" and "!"), it has no double-byte equivalent.

THE WINDOW FLAGS

Three of the 32-bit word parameters passed to Wimp_CreateWindow contain sets of flags which determine the properties of the window created. A flag may be considered as a variable which has just two possible values. For example, the flag which determines whether the window has vertical scroll bars or not can obviously only take one of two values. Wimp flags are each represented by a single bit of a given 32-bit parameter word - each bit taking the value 1 (TRUE) or 0 (FALSE).



```
WIMP WINDOW FLAG GENERATOR

Generates 32-bit window flag for use with Wimp_CreateWindow

Respond with Y (=YES) or any other key (=NO)
to questions below about the window you are creating

Draggable (bit 1)                          Y/N ? Y
Redraw Requests (bit 4)                    Y/N ? Y
Pane (bit 5)                               Y/N ? N
Extend beyond scrn (bit 6)                 Y/N ? N
Scroll event (with auto rpt) (bit 8)       Y/N ? Y
Scroll event (with no repeat) (bit 9) Y/N ? Y
GCOL (=not Wimp colours) (bit 10)          Y/N ? N
Windows below prohibited (bit 11)          Y/N ? N
Hot key events (bit 12)                    Y/N ? N
Back icon (bit 24)                         Y/N ? Y
Close icon (bit 25)                        Y/N ? Y
Title bar (bit 26)                         Y/N ? Y
Toggle Size (bit 27)                       Y/N ? Y
Vert scroll (bit 28)                       Y/N ? Y
Hor scroll (bit 30)                        Y/N ? Y
Adjust size icon (bit 29)                  Y/N ? Y

Window flag= &FF000312
```

Setting the flags with the Flagset program

The most complex of these sets of flags is the Window Flags group. They are situated at block%+28. Figure 2 gives the function of each. You will see from this that four of the flags are labelled "Arthur only". On the RISC OS Wimp, the information conveyed by them has been regrouped in the block of flags between bits 24 to 30, and we will ignore the Arthur versions. The very top bit (bit 31) should always be set (i.e. set to 1) to indicate that the four Arthur flags should be ignored.

WINDOW FLAGS (at block%+28)

0	Arthur only
1	Window can be dragged
2	Arthur only
3	Arthur only
4	Window has no graphics in work area so needs no redraw window requests
5	Window is a pane (on a tool window)
6	Window can extend outside scrn area
7	Arthur only
8	Generate scroll request events
9	As 8 but no auto repeat on arrow icons
10	Treat window colours as a GCOL rather than Wimp colours
11	Don't allow windows below this one
12	Generate key-pressed reason codes for "hot keys"
13-15	Reserved - must be zero
16-19	Used to return info only
20-23	Reserved - must be zero
24	Window has a Back icon
25	Window has a Close icon
26	Window has a Title Bar
27	Window has a Toggle Size icon
28	Window has a vertical Scroll Bar
29	Window has an Adjust Size icon
30	Window has a horizontal Scroll Bar
31	Ignore "Arthur only" flags

Figure 2

In the test program in part 1 of the series, the window flags were supplied as a single 32-bit hex value (&FF00000F). Because it is tedious to calculate such values for each window that you generate, and because the use of a separate variable for each flag would be cumbersome, listing 1 is presented as a shortcut. When you run the program it takes you through all the features covered by the window flags, requesting a yes/no response for each. At the end it prints out a single 32-bit hex value for the window flags, to be used at block%+28.

It is probably a good idea at this stage to run the program. The value obtained may be substituted at line 590 of the test window program from part 1 of the series. The meaning of each flag is largely self-explanatory, but one or two are more obscure. The flag at bit 4 should only be set if the window contains elements such as graphics which the Wimp cannot update automatically when redrawing the window. If the bit is set, then the Wimp will issue a Redraw request, and the task must respond to this by redrawing the appropriate part - as we shall see later in the series.

Flag 5 is only set if the window is a very special kind - a so-called pane like the window attached to the left-hand edge of a Draw window.

Flags 8 and 9 are only set if the task needs to know when the user has performed a scroll request. In many applications the task is not interested in whether the user has scrolled or not, since the Wimp handles the process on its own (if it needs help from the task it will issue a Redraw window request).

There are two possible palettes that a window can use, the ordinary GCOL palette (allowing up to 255 colours - colour 255 cannot be used because the value 255 is used as a flag), or the more restricted Wimp palette. Unless there are compelling reasons, it is simplest to keep to the Wimp palette. Bit 10 is set if you are using GCOL colours.

Flag 12 is only set if the task wishes to receive key-pressed events when unclaimed key presses are encountered by the Wimp. For further information on hot keys, see the article *A Desktop Hotkeys Utility* elsewhere in this issue.

THE WINDOW TITLE

The title of the window may be ordinary or anti-aliased text, or it may be a sprite. In any case it must fit between the horizontal bounding lines of the title bar at the top of the window. The title bar flags, which define these things, are placed as a 32-bit value in the parameter block at block%+56, and the text (or the sprite image) is passed at block%+72 upwards. We will start by looking at the flags. But to keep things simple I will only list those which you are likely to use when setting up text-based titles. If you want to use a sprite, for this purpose, you are referred to the new PRM (i.e. the RISC OS *Programmer's Reference Manual*) pages 1177 onwards.

SELECTED TITLE BAR ICON FLAGS

0	Icon contains text
1	Icon is a sprite (=0 for text)
3	Contents centred horizontally
4	Contents centred vertically
6	Text is anti-aliased
9	Text is right justified
24-31	Font handle (anti-aliased text)

Figure 3

For a simple text title, there is very little work to do. To give horizontally and vertically centred system font text the flag should take the value 11001 binary (&19 hex). The value used in the program two issues back was &3D. This only differs from &19 in that bits at 2 and 5 (which are always ignored) were set high rather than low - either &19 or &3D are thus equally valid. If you are interested in using anti-aliased text in the title, you are referred to the new PRM, though this is a subject to which I hope to return later in the series.

There remains the title string itself. This is most simply handled by placing it as a text string at block%+72 onwards. It must be of no more than 12 characters, and must be terminated by the addition of a control character (e.g. ASCII 0 or ASCII 13) if it is less than 12 characters in length. This is achieved in line 750 in the test program:

```
750 $(block%+72)="Test Window"
```

The control character ASCII 13 is automatically appended by the $ operator.

THE WORK AREA FLAGS

The final set of flags used by Wimp_CreateWindow are the work area flags. These are concerned solely with the response of the Wimp to the mouse. And although the whole of the 32-bit word at block%+60 is set aside for this purpose, only bits 12-15 are used. Figure 4 gives the possible values which these four bits may take. It is important to note that in contrast to the other sets of flags the 4 bits here are treated as a single 4-bit word which can take one of 16 unique and mutually exclusive values (i.e. any integer in the range 0-15).

Work Area Flags

0	Ignore all clicks
1	Notify task continually while pointer is over work area
2	Click notifies task (auto-repeat)
3	Click notifies task (once only)
4	Release over work area notifies task
5	Double-click notifies task
6	As 3 but can also drag
7	As 4 but can also drag
8	As 5 but can also drag
9	As 3
10	Click returns button state*256 drag returns button*16 double-click returns button*1
11	Click returns button state drag returns button state*16
12-15	Reserved
15	Mouse clicks cause window to gain input focus (e.g. for text entry)

Figure 4

An example should clarify this. In our test program we have used the value 3 (i.e. "Click notifies task"). We have installed this value by shifting the number 3 by 12 bits to the left. The value 3<<12 (i.e. &3000) is then stored at block%+60. The exact value chosen for the task will appear more relevant when we begin to look at Wimp_Poll. This will return a reason code when the user clicks the mouse within the appropriate window only if the work area flags are set up accordingly.

Next month we begin an assault of the Wimp poll routine.

Listing 1

```
   10 REM   >Flagset2
   20 REM   by Lee Calcraft
   30 REM   Generates Window Flags
   40 :
   50 MODE12
   60 flag%=1<<31:REM set top bit
   70 PRINT"WIMP WINDOW FLAG GENERATOR"
   80 PRINT'"Generates 32-bit window fla
g for use with Wimp_CreateWindow"
   90 PRINT'"Respond with Y (=YES) or an
y other key (=NO)"
  100 PRINT"to questions below about the
 window you are creating"'
  110 REPEAT
  120 READ A%,A$
  130 IF A%<255 THEN
  140 PRINTA$;" (bit ";A%;")";TAB(38)"Y/
N ? ";
  150 B%=GET AND &DF
  160 B%=-(B%=ASC"Y")
  170 IF B% THEN PRINT"Y" ELSE PRINT"N"
  180 flag%+=B%<<A%
  190 ENDIF
  200 UNTIL A%=255
  210 PRINT'"Window flag= &";~flag%
  220 END
  230 :
  240 DATA 1,Draggable,4,Redraw Requests
  250 DATA 5,Pane,6,Extend beyond scrn
  260 DATA 8,Scroll event (with auto rpt
)
  270 DATA 9,Scroll event (with no repea
t)
  280 DATA 10,GCOL (=not Wimp colours)
  290 DATA 11,Windows below prohibited
  300 DATA 12,Hot key events
  310 DATA 24,Back icon,25,Close icon
  320 DATA 26,Title bar,27,Toggle Size
  330 DATA 28,Vert scroll,30,Hor scroll
  340 DATA 29,Adjust size icon,255,
```

Archimedes Public Domain Discs

***Norwich Computer Services** has published a range of public domain program discs of which this is a selection. Send an S.A.E. for a full list.*

Shareware Nº2: DFS reader, backup and archiver, 9 graphics demos, 256 colour Sprite Editor, CMOS ram Editor, Disc Copier, LQ printer Font Definer, Matrix Functions, BASIC Fast Screenload, Connect Four, Mastermind, Solitaire and Star Trek.

Shareware Nº5: 51 pieces of music, some classical, some modern, for the Music Editor.

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Shareware Nº8: "YAIG" – Yet Another Invaders Game with excellent sprites and animation (Needs 1 Mbyte.)

Shareware Nº9: Various graphics demos, file utilities (EXALL, disc tree printer, filetypes and 'filedo' utilities and a disc recoverer), mode 15 to 12 converter, palette converter (Arthur to RISC-OS), NEC printer utilities, two fast fade programs, System Delta Plus export utility, ADFS disassembler (Arthur only), bank account manager and three games: 3D breakout, bowls and roller ball.

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Shareware Nº11: 6 concerti in Maestro form – Beethoven, Chopin, Grieg, Liszt, Mozart and Schumann.

Shareware Nº12: Descent to Xeer, Rubik's cube, *settype and *stamp files from the desktop, BASIC compressor, Sinclair QL disc reader, Calculating your central heating requirements, Making cassette inlays, Floppy drive speed test, Address book.

Shareware Nº13: Hard disc backup, Rubik's clock, Interrupt module, Dustbin, Outline processor, Mandelbrots, Video database, Calendar, Golf.

Shareware Nº14: 'Arctist Plus' – 256 colour art package.

Shareware Nº15: 14 graphics demos, 2 !Draw fonts, 6 !Maestro tunes, 20 Sampled sounds.

Shareware Nº16: contains (another) 256-colour art package, link to Psion organiser and the latest version of the YAIG game which works in the overscan mode giving much greater screen area in which to play.

Careware Nº1: Calendar, Label Printer, "Make" utility, Othello, Sliding block puzzles, Simon, various small demos & games.

Careware Nº2: Asteroids, Backgammon, Fractal curves, Desktop Calendar, ARM disassembler, Disc editor (ADFS & MS-DOS), Icon for BASIC editor, BASIC program compressor.

Careware Nº3: Breakout, Fruit machine, 3D O's&X's, Forth language, Hard Disc backup, Graphical file dump, 'Examine' for MS-DOS, and (another) Icon for BASIC editor.

Careware Nº4: Euclid/Mogul animation by Malcolm Banthorpe, Serial link to BBC micro, !BIN – file deletion application, !PCdir – converts files to and from MS-DOS, 3D adventure game, Screen blanking routine, WP file conversion routines, Function key strip printer and some more tunes for use with Maestro.

Shareware Discs £3.50 each, Careware Discs £7 each

(N.B. **All** the money received for the Careware discs is donated to charity.)

Send cheques (sorry, no credit card facilities) to:

Norwich Computer Services, 18 Mile End Road, Norwich, NR4 7QY.

Phone: 0603–507057 Fax: 0603–250095

A Module Information Utility

by Mike Ironmonger

This RISC OS Desktop utility will provide comprehensive information on all the ROM modules currently installed in your system. The utility is supplied as an application which can be started by double-clicking on the !ModInfo icon. A window then appears listing all the current modules and their present state (running, active, dormant, or unplugged). Clicking on the status information allows you to alter their state. Be careful, though, not to unplug modules, like RamFS or ADFS, which you may well need to use. If you independently cause the status of any module to change (creating a RAM disc causes the state of RamFS to change from *dormant* to *active,* this will not be reflected in the module list unless this is recreated.

Clicking on the name of any module in the list will provide detailed information on that module and all relevant addresses. If the module recognises one or more star commands (indicated by the *Command keyword table* entry), then clicking on this will open a further window listing all the relevant commands. If the module has any associated SWI calls, then clicking on any of the *SWI* address entries will list all the SWIs for that module by name and address. The name of each SWI is given as a suffix which follows the generic SWI name for that module, and this is shown to the right of the module name. For example, the *WindowManger* module will show the generic SWI name as *Wimp*. Thus the utility provides a quick and easy way of finding all relevant commands and SWI calls for any module.

Because of space constraints, this program is included on the magazine disc only.

RU

Into the Arc (continued from page 37)

click on the 'OK' box to confirm the colour you have chosen or you may be left wondering why these options appear to have no effect.

There is no fill option as such. Once a fill colour has been selected from the menu, any new object created (closed or open) will be filled with the specified colour. For wire-frame objects with no colour fill, you select *None* as the fill colour (and this is the default).

Another potentially confusing option is *Pattern,* as this determines the style of a line (solid, dashed, dotted etc) and not the choice of fill pattern as might be thought. Finally, in this section, you can specify the way in which two lines join, and how the start or end of a line is to be shaped, though the possible effects will normally only be visible in the larger line thicknesses.

That, I think, covers all that you need to know to construct and edit simple objects using the Draw application. Of course, there are many other features to this software, all of which are described, if briefly, in the User Guide. However, if you have read this article about the drawing of simple objects, and have practised this for yourself until you feel reasonably confident of your abilities, then I am sure you will find the manual's description of all the remaining features much easier to read and assimilate than you might have thought. Above all else, experimenting with your own drawings is by far the best way to learn.

RU

Assembler Workshop

Lee Calcraft presents ideas on error handling, and more hints on debugging

Error Handling

GENERATING ERRORS

In machine code, there is no sophisticated error reporting system like the one provided in Basic. The ARM programmer must detect all errors with his own code, and deal with each as he sees fit. Exactly how he does so depends on whether his code forms part of a so-called System Extension (e.g. a module, a transient utility or an interrupt handler). For the moment we will assume that the code does not fall into this category. In such cases we can make use of the SWI call "OS_GenerateError". It can be used as follows:

```
CMP  R0,#maxvalue
BGT  maxerr
:
.maxerr
ADR  R0,ertxt1
SWI  "OS_GenerateError"
.ertxt1
EQUD  255
EQUS  "Value out of range"
EQUB  0
ALIGN
```

In other words, the SWI must be executed with R0 pointing to an error block. The first word of which contains an error number. This is followed by a zero-terminated message. The error block must be word-aligned, and must be no more than 256 bytes in length.

After reporting the error, the program stops. If you call the machine code from Basic, it will use Basic's error reporting facility, using the supplied string as the REPORT$, and the number as the error number. You could easily construct a block of error handling code following these lines, with messages for all expected error types. If you do so, you do not need to use a different error number for each. The only real advantage of using different numbers is to allow a Basic error handler to behave differently for different categories of error. For example it could be made to display the Basic error line number only for error numbers other than 255.

There may be circumstances where you want to include a variable value in an error message (such as the record number of a faulty block of data). A simple way to do this is to set aside an error number (say 254), and to store the record number of the faulty line in a block of RAM before calling the handler. The Basic error handler could then pick this up. An example should clarify this:

```
CMP   data,#ASC"#"
BNE   markerror
:
.markerror
BL    getrecno
ADR   R0,ertxt2
SWI   "OS_GenerateError"
.ertxt2
EQUD  254
EQUS  "No record marker"
EQUB  0
ALIGN
```

The program is looking for a "#" used as a record marker of some sort. If it is not found, the error handler is called. This first branches to the subroutine *getrecno* whose function is to count the number of records from the start of the file to the error, and place the result in RAM at say block%+4. The error code is then called, and if we use a Basic error handler similar to the following:

```
IF ERR=254 THEN PRINT REPORT$" in
data block at record ";block%!4
```

The user will then see the following message: "No record marker in data block at record 56", or whatever.

ERRORS IN SYSTEM EXTENSIONS

As we mentioned in last month's Workshop, system extensions such as modules and transient utilities must not generate errors. In the case of all SWIs in such code which could generate errors, a special form must be used (called Error-returning SWIs - as opposed to error generating SWIs).

The same restrictions apply to our own error handler. Thus if you wish to generate an error within a system extension, you should set the overflow flag, and exit from the module or whatever with R0 pointing to your error block. The code above then becomes:

```
CMP    data,#ASC"#"
BNE    markerror
:
.markerror
BL     getrecno
ADR    R0,ertxt2
ORRS   PC,R14,#1<<28
.ertxt2
EQUD   254
EQUS   "No record marker"
EQUB   0
ALIGN
```

This assumes that R14 holds the return address from the module. If it has been stacked it must be unstacked before the ORRS instruction (whose effect is to place the contents of R14 into the progam counter, and simultaneously set the overflow flag).

DETECTING ESCAPE

In a Basic program, if you press the Escape key, an error is automatically generated, and by default Basic's error handler will signal the error. Once again, if you are programming in ARM code, you must include specific code to trap this. Two SWIs, OS_ReadC and OS_ReadLine automatically report the pressing of Escape by returning with the carry flag set. But in other cases you must periodically call SWI "OS_ReadEscapeState". If Escape has been pressed, it will return with the carry flag set. You could then branch to an error handler similar to the above. For example:

```
SWI    "OS_ReadEscapeState"
BCS    escerror
.
.escerror
MOV    R0,#&7E
SWI    "OS_Byte"
ADR    R0,esctxt
SWI    "OS_GenerateError"
.esctxt
EQUD   17
EQUS   "Escape"+CHR$0
ALIGN
```

You will see that we have called OS_Byte &7E early in this routine. The purpose of this is to acknowledge the escape condition (see the new *Programmer's Reference Manual* page 497). For further details on error handling, see the new PRM, pages 37-41. But note that the example given on page 41 of the PRM is incorrect, and omits to call OS_Byte &7E after the detection of the escape key.

DEBUGGING USING CONDITIONAL ASSEMBLY

By a simple ruse it is possible to achieve so-called conditional assembly using Basic's assembler. In other words we can make the assembly of certain parts of our code used for debugging purposes, conditional on the value of a flag or variable. The ability to switch debugging on and off in such a simple way can be very powerful, and has the advantage that when the debugging code is switched off, it does not even get assembled, so that it does not feature in the final program. But as soon as you want to debug your code, you can switch it on again. Take a look at the following:

```
FOR pass=0 TO 3 STEP 3
100 [OPT pass
110 STMFD  R13!,{R14}
.
user's code
.
500 ]
510 IF debug% THEN [OPT pass:BL
debug:]
520 [OPT pass
.
user's code
.
700 LDMFD  R13!,{PC}
.
900 ]NEXT
```

Line 500 turns off the assembler. Then line 510 checks the value of the flag *debug%*, and only assembles the instruction BL debug if the flag is TRUE. Line 520 restarts the assembler so that the rest of the program is assembled correctly.

You can take this one stage further, and use different bits of *debug%* to control the assembly of different debugging devices installed within your code. The variable debug% can be set up early in the program, and easily adjusted. Or you can even store its value in CMOS RAM so that the level of debugging can be altered without editing the program in any way, but is nevertheless retained after power-off.

Designed, & typeset

IMPRESSION

Impression is more than a word processor. It can handle all aspects of the final printed result - the text, line graphics, photographs, company logos etc. Yet it can still be used to bash out a single page of text as well as any 'simple' word processor. It is a document processor.

RISCOS

Impression is one of the first products to take full advantage of the new multi-tasking WIMP based operating system for the Archimedes, so it is simple and intuitive to use - long gone are the days when users had to remember commands, or codes for each operation. Only five main menu options control everything within Impression.

The program is written in ARM assembler so it is very fast and very responsive, and uses the minimum possible RAM space.

Frames

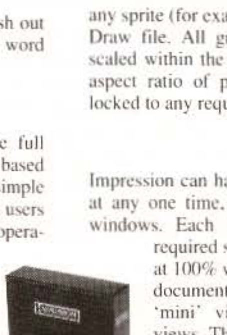
Impression is a frame based page layout system. All objects on the page are held within frames which may be positioned freely anywhere on the page. Frames can contain text or graphics, they may overlap, and may be transparent or have any coloured background. They can have a variety of borders displayed around them and may be arranged in columns to create multi-columned text.

Text frames may be linked to other text frames (even on subsequent pages) so text will automatically flow from frame to frame and page to page. Since Impression has been designed primarily as a word processor, it is important that users can enter text unhindered. Therefore frames and pages are created automatically as text flows out of a frame, so that while text is being entered you do not have to worry about creating new frames or pages.

Graphics frames may contain any sprite (for example images from Scan-Light) or any Draw file. All graphic frames may have the picture scaled within the frame to any degree. In addition the aspect ratio of pictures can be controlled and even locked to any required value.

Windows

Impression can handle up to 16 documents in memory at any one time, each being viewed in one or more windows. Each individual view may be scaled as required so that, for example, one view may be at 100% while another window shows the same document scaled to 20% so showing a live 'mini' view or multiple page 'thumb-nail' views. This mechanism also allows two different parts of a document to be edited without the need to scroll between them. Impression can display its pages within the window as side-by-side left/right pages, and as vertically arranged pages in a more word processor-like fashion. There is no need to specifically turn over the page, thereby overcoming a limitation of traditional DTP systems.



Spelling checker

Included with Impression is a 60,000 word spelling checker providing some of the most advanced spelling facilities. Check-as-you-type, user dictionaries, ignore dictionary, crossword and anagram solving and an intelligent 'guess' feature are included. Other related dictionaries control automatic abbreviation expansion as you type, and a hyphenation exception dictionary for precise hyphenation control over and above the normal automatic hyphenation.

arranged on

Styles

Like the most powerful word processors on the Mac, Impression supports a system of styles. Rather than having fixed text effects such as bold, underline etc, Impression allows the user to apply any user named style to any part of the text. This style may be defined and re-defined at any time to represent any combination of stylistic effects. So for example one style, perhaps called 'heading', may specify text to be in a Times font, one inch high, in italics and centered. This style may then be applied to any region of text with one key-press.

Printing

Included are the latest RISCOS printer drivers for Epson compatible 9 and 24 pin printers, and LaserJet compatible laser, ink-jet, and PostScript printers. These printer drivers ensure the output is to the maximum resolution the printer can manage. Impression also supports 'text mode' draft printing so text may be output as fast as possible using the printer's character set. The user therefore has a choice between fast, text only printing or high quality text (any font, any size) and graphics printing.

> *Impression comes with a 'no quibble' money back guarantee when purchased direct from Computer Concepts.*

This advert was designed, entered, laid out and edited on Impression. All logos were created in Draw and imported into Impression frames. The pages were then 'printed' via the PostScript printer drivers to disc. This disc file was then sent directly to a Linotron photo-typesetter, which output the final camera ready artwork. The studio photographs were then pasted over scanned versions.

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Hints & Tips. . . Hints & Tips

WORDWISE PLUS ON THE ARC

Philip Draper

In the absence of a good word processor on the Archimedes, many former Beeb owners are still using Wordwise Plus, but the problem is how to define function keys. On the Beeb this would be done with a !Boot file, but that supplied on the Archimedes Wordwise disc serves another purpose. One solution is to edit the file Runit which consists of the three lines:

```
*RMLOAD 65Tube
*EMULATETUBE
*WW+
```

One can insert key definitions between the second and third lines, including any *FX commands, and all works well.

This can be improved upon by having different files for different types of document, provided they all have the necessary three lines. If one sets them to be filetype 'command' (*SetType <filename> &FFE) one can double click on them from the Desktop without bothering with the !Boot file at all. The only proviso is that WW+ and 65Tube both need to be on the same disc as the command files if you have only one drive.

1ST WORD PLUS

C.Dawson

If you have installed RISC OS, then the information for dual drive systems given in the article Making the Most of 1st Word Plus from RISC User Volume 2 Issue 8 page 32 is incorrect. The required file is !Run in the applications directory !1stWord+ (press Shift and double click on the !1stWord+ icon to open the application directory). !Run should then be edited using the Edit application, when the 4th line can be changed from &.1wp to :1.$.1wp and the edited file saved back to disc. Using a separate data disc in drive 1 will allow many more documents to be held on the same disc.

This process should be created for all other elements in the 1st Word Plus set of programs such as !1st Mail etc.

On another note, don't forget to regularly deleted unwanted files from your 'bak' directory in order to keep the maximum free space available.

FAST MULTI-FILE COPYING (1)

Lee Calcraft

If you have a single floppy drive, then copying from one floppy to another can be a pain. If you are backing up (i.e. copying the entire contents of one disc to another), you can use the quick option - i.e.: *BACKUP 0 0 Q But remember that the -quick-option uses user RAM, and will therefore destroy any program currently in RAM.

If you want to copy a number of selected files, you can get involved in a large number of disc swaps if you are not careful. Below, we give three other ways to keep things fast.

FAST MULTI-FILE COPYING (2)

Use the RISC User -Fast Directory Copier- utility, designed specifically for the purpose. See RISC User Volume 1 Issue 6 page 5.

FAST MULTI-FILE COPYING (3)

Use the RAM disc. Click with the Menu button over the Archimedes icon at the far right of the icon bar on the Desktop; select -Task Display-, and allocate as much RAM as possible to the RAM disc. Then open the RAM disc (whose icon should now be on the icon bar). Insert your source floppy, and drag files to be copied over to the RAM disc filer. When this is full, insert your destination floppy, open its filer, and drag the contents of the RAM disc into the destination filer. This will allow you to copy all the files that will fit into the RAM disc, with a single disc change. Continue the process if there are still more files to be copied.

FAST MULTI-FILE COPYING (4)

If you have a hard disc, the quickest way to copy files from one floppy to another is to open a directory on your hard disc called -Temp-, say, and then drag files from the source floppy to Temp. Then insert your destination disc, and drag them back out. If you press Shift before the second drag, and hold it down, the files will be automatically deleted from Temp when the second copy is made.

SAVING ROM AND RAM WIMP SPRITES

Lee Calcraft

The following three lines of code will save to disc a file called RomSprites containing the ROM-based Wimp sprites, and a file called RamSprites containing the RAM-based Wimp sprites (though there may be none of the latter resident if you have not recently opened a filer with RISC OS applications in it).

```
SYS "Wimp_BaseOfSprites" TO rom%, ram%
SYS "OS_SpriteOp",268,rom%,"RomSprites"
SYS "OS_SpriteOp",268,ram%,"RamSprites"
```

To view the sprites, you can load them into the system sprite area (you may need to assign some sprite space beforehand using the Task Manager):

```
        *SLOAD RomSprites
then    *Slist
```

to list them or:

```
        *SCHOOSE name
        PLOT &ED,0,0
```

to display them (where name is the name of one of the sprites listed).

65% MORE ROOM ON THE DESKTOP

If you find your Desktop a bit crowded at times, try using mode 16 (click Menu over the palette icon on the icon bar, move the pointer over the -Mode- selection, then move the pointer to the blank position at the bottom of the menu of possible modes, and when the red caret appears, type in "16"). If you have insufficient RAM, you will need to allocate a bit more using the Task Manager - you need 132K for this mode.

The advantage of mode 16 is that it gives a 16 colour palette, but has a much wider graphics area than normal. The resolution in this mode is 1056x256, but the operating system works on a resolution of 2112x1024 (the norm for all the better-known modes is 1280x1024).

To make the most of this mode you will really need a good resolution monitor, though a multi-sync is not essential.

JITTERY TAXANS

Adam Goodfellow

If you have a Taxan multi-sync monitor and a new 400/1 series machine, you may be experiencing screen jitter as your system warms up. This can be fixed by fitting a link at LK2 on the Arc's main PCB (near to the serial port at the rear of the machine).

Archimedes Upgrades

2Mb RAM for A3000 (Acorn)	£215
2Mb RAM for A3000 (Morley)	£165
A3000 computer	£746.35
A305/310 to 2Mb & 4Mb RAM	£POA
New MEMC 1A memory controller	£POA
A3000 serial upgrade	£21.50
2-slot backplane + fan	£22.95
4-slot 4-layer b'plane + fan	£62.95
(Deduct £10 if fan not needed)	
Computerware 40Mb disc + card	£590
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RISC OS Progr. Ref. Manual	£79

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Please write or phone for our free current price list, which provides detailed information on RAM upgrades for the A310, and the MEMC 1A.

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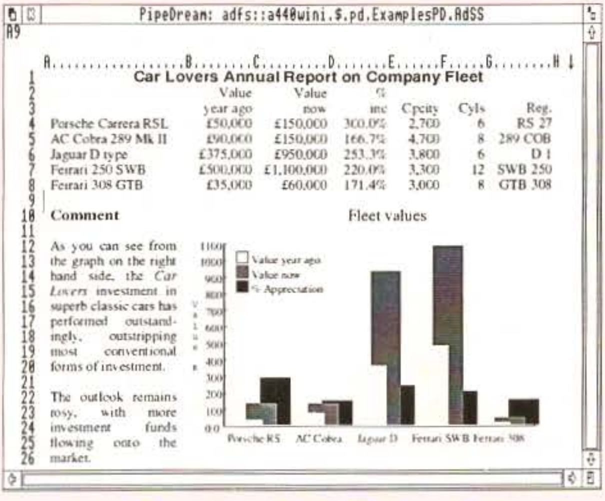
PIPEDREAM 3



PipeDream: adfs::a440wini.$.pd.ExamplesPD.AdSS

A9

Car Lovers Annual Report on Company Fleet

	Value year ago	Value now	% inc	Cpcity	Cyls	Reg.
Porsche Carrera RSL	£50,000	£150,000	300.0%	2,700	6	RS 27
AC Cobra 289 Mk II	£90,000	£150,000	166.7%	4,700	8	289 COB
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Comment

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Postbag

This month's Postbag is entirely devoted to a letter from Paul Fellows, author of the Dabs Press Basic compiler ABC, regarding the comparative review of this and Silicon Vision's Risc Basic published in RISC User Volume 2 Issue 8. We include a reply from reviewer Mark Sealey. In both cases the letters have been edited to accommodate them in the available space.

BASIC COMPILERS

I was interested in the comparison of two Basic compilers in RISC User Volume 2 Issue 8. Unfortunately the author seems to have completely failed to get to grips with ABC, and has misjudged a few vital points.

Despite being sent a production version of ABC2, the author has quoted timings for a much older version in which optimisation was switched off to aid debugging. This is most dramatically illustrated by the timing quoted for the FOR-NEXT benchmark. The production version of ABC2 spots empty loops and discards them. Thus the timing comes out as zero seconds. Other optimisations, while less significant, do affect timings as can be seen.

The author stated that all timings were carried out on the same hardware with the same source code. Is that fair? No, because he used the performance enhancing directives of RiscBasic, but refused to use those provided by ABC. The following table illustrates the dramatic difference when a couple of REM directives are added to ABC or the RiscBasic Turbo directive is removed.

	RB	ABC	RB	ABC
	(with)		(without)	
FOR loop	1.34	0.00	9.92	3.09
Ack(3,4)	0.14	0.07	0.24	0.16
Intmath	0.16	0.18	0.24	0.30
StringSort	114.6	1.96	117.2	2.72

Timings for RiscBasic V1.70 (RB) and ABC V2.29 (ABC) with and without directives.

With regard to the ABC shared library, the author has failed to appreciate the benefit of the system provided by ABC. All RiscBasic programs include a copy of all runtime routines and are thus at least 18K bytes long. ABC programs are as small as 2K, but use a 16K byte shared library. With one program things are equal, but under RISC OS there will typically be many programs running at once. It is very wasteful if each of these has to have its own copy of library routines.

It is true that ABC may not compile your program straight away. It is true that when compiled, your program may not immediately go many times faster. And it is true that when run your program may not even work exactly as it did under the interpreter.

ABC is not designed as a 'quick fix' for your speed problems. Some degree of effort is needed to get the most out of the system. ABC produces robust object code which is consistently fast, however large or complex your program. If your program is worth compiling, it is worth compiling with ABC.

Paul Fellows

Mark Sealey replies:

I have checked the benchmarks I compiled and stand by them entirely. I was using ABC V2.29 as supplied by Dabs, but also RiscBasic in a later version than I suspect Paul Fellows had at his disposal (V1.92). I cannot agree about the 100,000 iteration FOR loop. In the case where a loop had been put in a program to slow it down and was deliberately empty, ABC2 would frustrate this intention. After all, why put an empty loop in? For fun? If it's there, it is there to be compiled.

My timings for the ABC Ackerman program are around 0.27. This is slower than with Risc Basic, with or without Turbo. Indeed I did use the later version in all timings, *except for the ABC FOR loop as I felt it was a 'cheat'.*

The Turbo directive issue is something of a red herring: if a compiler can optimise code by being able to do what a rival cannot (catering for single exit loops for example), then it is surely legitimate to quote timings reflecting the benefits of using it.

It is not true to say that I "refused to include .... (the performance enhancing directives) completely". All ABC2 compiled sources had the Escape check switched off, and were done under identical conditions as far as floating point arithmetic calculations were concerned. Intmath as compiled by RiscBasic is superior in timings whatever directives are set.

On the ABC shared library there are two issues. The first is size, and I cannot see why Paul feels I have misjudged such a vital point. On multi-tasking, I cannot believe that he really expects us to swallow the "many applications at once" paragraph. This also raises the question of who will actually be using these compilers. Most home users will probably be interested in speeding up their own programs - there is little chance of there being multiple applications all sitting on the icon bar doing important jobs and all the happier for not being 16K longer than necessary. It may be professional software developers who will use ABC, but I doubt it. In either case it doesn't seem the sort of difference that could make or break a product.

Mark Sealey

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SOFTWARE

Technical Queries

MORE ABOUT ARM CODE

Dear Sir,

I thoroughly enjoyed the series "Introducing ARM Assembler" (RISC User Volume 1 Issue 5 to Volume 2 Issue 3), and would be grateful for your advice on the following topics:

1. Where can I get hold of a floating point assembler?

2. Is the Archimedes floating point co-processor available, and is it a worthwhile investment?

3. What is the best way to perform floating point multiplication and division, and to find sines, cosines etc?

George Gaskin

The answer to your first question is easy - we are covering this topic elsewhere in this issue, and the magazine disc contains a complete floating point assembler.

As to whether the co-processor (recently released by Acorn) is a worthwhile investment or not depends largely on your need for speed. The only advantage of the co-processor over the floating point emulator is that it runs much more quickly: but exactly how much more, we will not know until we have bench-tested the co-processor (in a forthcoming issue).

But when considering its purchase (at a price of £599 +VAT), you must remember that it will give no increase in speed with Basic V (though compiled Basic will run faster). It will only affect applications compiled from C or Pascal (such as Acorn DTP, Pipedream, Draw etc). Additionally it will affect applications written in native ARM code which make use of floating point instructions, though I am not aware of any major application taking this course.

Pound for pound, the ARM 3 upgrade for the Arc seems to offer a much greater speed increase across the board. For example, with this upgrade (which costs 595 +VAT), -everything- (including Basic programs) will run at least 2.5 times faster. And some applications will show an even greater speed increase. See the review of the ARM 3 upgrade elsewhere in this issue.

Finally you ask about performing floating point multiplication, division and trig functions. Unless you are sure to have a floating point co-processor in your machine, then all of these operations will be performed much more quickly if you avoid the use of the floating point instructions to perform them.

The fastest way to implement trig functions is to use look-up tables created beforehand, as you suggest elsewhere in your letter. Such tables are easily created in Basic. But if you need very high precision, this becomes impractical because of the size of the table required, and you will have to resort to floating point instructions.

As far as other arithmetic operations are concerned, the fastest method will always be to use ARM code to perform fixed point operations. For example, you could notionally set the decimal point between bits 15 and 16. This is a topic which we will be covering in a forthcoming ARM Workshop.

Lee Calcraft

Dear Sir,

I am pleased with your series explaining windows in RISC OS. However, to be useful, I need a way of making my Basic programs truly multi-tasking. In the articles, the program is effectively called by the Wimp system, but the program might take some time to complete its task and this delay could be unacceptable. There surely must be a way of making Basic programs multi-tasking so that no one program can hog the system.

Jack Pike

The simple answer is 'No, there isn't'. The Wimp system on the Archimedes is co-operative, and relies on multi-tasking programs being well behaved and not hanging on to the processor. The possible drawbacks of this are easily demonstrated with the clock (and some other programs on the two Applications discs), which come to a complete halt when any heavy processing takes place. The only solution with your own programs is to ensure that the WimpPoll routine is called as quickly as possible after it returns from the previous poll, to allow other programs a chance to run.

So-called Pre-emptive multi-tasking systems do exist, where the operating system controls how much processor time each program is allowed in turn, and these are often used in multi-user systems to ensure that each user (program) gets a fair proportion of the available processor time.

Mike Williams

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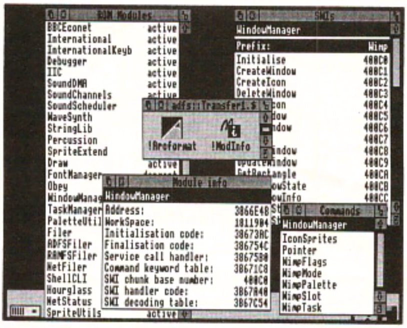

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BBCEconet          active
International      active
InternationalKeyb  active
Debugger           active
IIC                active
SoundDMA           active
SoundChannels      active
SoundScheduler
WaveSynth
StringLib
Percussion
SpriteExtend
Draw               active
FontManager
Obey
WindowManag
TaskManager
PaletteUtil
Filer
ADFSFiler
RAMFSFiler
NetFiler
ShellCLI
Hourglass
NetStatus
SpriteUtils        active
```

```
WindowManager
Address:                   3866E48
WorkSpace:                 1811904
Initialisation code:       38673AC
Finalisation code:         386754C
Service call handler:      38675B0
Command keyword table:     38671C8
SWI chunk base number:       400C0
SWI handler code:          3867A40
SWI decoding table:        3867C54
```

```
WindowManager
Prefix:                Wimp
Initialise             400C0
CreateWindow           400C1
CreateIcon             400C2
DeleteWindow           400C3
                       400C4
                       400C5
                       400C6
                       400C7
                       400C8
UpdateWindow           400C9
GetRectangle           400CA
                       400CB
                       400CC
```

```
WindowManager
IconSprites
Pointer
WimpFlags
WimpMode
WimpPalette
WimpSlot
WimpTask
```

RISC OS 2.0 Extensions (450K)

The latest versions of certain modules and applications - RISC OS bug fixes and enhancements, including new printer drivers for Epson and PostScript. New printer drivers for Integrex colour and HP Laserjet will be added next month.

A Module Information Utility

Full information on all resident modules from the Desktop at the click of a button.

Floating Point Assembler

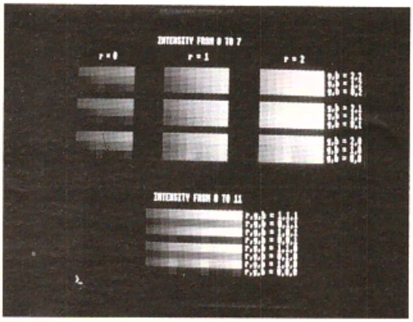
Assembler functions for Basic V to handle the ARM co-processor's floating point instruction set.

Sample Screens

From Computer Concepts' Impression package.

Noughts and Crosses

A multi-tasking 3-dimensional noughts and crosses game.



Archimedes Visuals - Colour Series

A demonstration of a function for producing colour sequences.

ArcScan Data

This month's ArcScan data files.

Plus the following programs from RISC User magazine:

ROM Modules Info Utility

A multi-tasking program which allows you to manage and examine ROM modules.

Making Backups

A short utility to save a backup copy of a current Basic program.

Mastering the WIMP - Creating Windows

A short utility for creating the window flag word.

A Desktop Hotkeys Utility

An application providing single-key shortcuts from the Desktop.

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